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# ***JPRS Report***

## **Soviet Union**

### ***AVIATION & COSMONAUTICS***

No 8, August 1987

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# **Soviet Union**

## **AVIATION & COSMONAUTICS**

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[The following is a translation of the Russian-language monthly journal, AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the Table of Contents for a listing of any articles not translated.]

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## AVIATION & COSMONAUTICS

### Restructuring Effort Proceeds in Air Force

91440420a Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 8, Aug 87 (Signed to press 3 Jul 87)  
pp 1-3

[Article by Mar Avn A. Yefimov, air forces commander in chief, USSR deputy minister of defense, twice-awarded Hero of the Soviet Union: "The Wings of the Motherland of October"]

[Text] As with all the people, this year military airmen, creators and developers of aviation equipment and air force veterans are celebrating their traditional holiday—USSR Air Force Day—during an important period saturated with revolutionary transformations in the development of our socialist society. The appeal of the Central Committee of the Communist Party of the Soviet Union to Soviet people and the CPSU Central Committee decree "On Preparation for the 70th Anniversary of the Great October Socialist Revolution" were met with an enthusiastic response in the hearts of fliers, engineers, technicians, specialists in the air forces rear services and communications, and cadets and students of air force military educational institutions, eliciting in them deep patriotic feelings and pride for our great motherland.

In our consciousness, Great October is an event of the greatest national pride and historical significance. It was the point of origin of a fundamentally new, just social structure, and it paved the people's way to socialism: Today over a third of mankind has already cast off the shackles of capitalist exploitation.

Tremendous changes also occurred in the development of Soviet aviation in the decades since then. The history of its origin and maturation in the course of combat is inseparably associated with V. I. Lenin and other prominent officials of our party and the Soviet state, who correctly defined the exceptionally important role played by the air force in the solution of major national economic problems, in scientific-technical progress and in reinforcement of the defenses of the Republic of the Soviets.

In the difficult years of civil war our aviation successfully conducted air reconnaissance, struck enemy troops and equipment on the ground, adjusted artillery fire and provided cover to friendly troops against air strikes. Hundreds of sorties were flown by valiant Red Army military pilots into the enemy rear with the purpose of dropping leaflets and other publications in the interests of propaganda and agitation.

In subsequent years Lenin's party showed constant concern for the development of the air force of the Soviet fatherland, and for increasing the fighting power of military aviation. In September 1920 the Council of Peoples Commissars adopted a decree allocating money for construction of airfields in Kirsanov, Saratov and

Rzhev. Schools and short courses were organized on V. I. Lenin's personal instructions in order to train commanders, political workers, engineers and technicians.

The motherland of October enjoyed notable successes in the development of the air force in the mid-1930s. It transformed into a major world air power. Pilots A. Lyapidevskiy, S. Levanevskiy, V. Molokov, N. Kamanin, M. Slepnev, M. Vodopyanov and I. Doronin distinguished themselves in the heroic saga of the rescue of an expedition from Cape Chelyuskin. They were the first in our country to be awarded the Hero of the Soviet Union title. The heroism of the courageous crew consisting of V. Chkalov, G. Baydukov and A. Belyakov that completed a long-distance flight from Moscow to the Far East by way of the Far North and Kamchatka became a brilliant page in the history of Soviet aviation, as did the legendary trip over the North Pole to America.

During the time of the first five-year plans the party made an enormous effort to create the material-technical base of socialist industry and to fortify the country's defense capabilities. During this period the party Central Committee and the Soviet government undertook a number of energetic measures directed at raising the fighting power of the air force. Units and formations were formed, they were armed with new types of airplanes, the organizational structure of the air force was improved, and the airfield net was widened.

Successful implementation of this complex of measures made it possible to more than double the air force's airplane fleet and to almost double the quantity of air regiments by spring 1941. In the first half of 1941 USSR aviation industry manufactured over 2,000 fighters, 1,595 bombers and 249 attack aircraft. The Soviet Air Force was armed with 2,739 new airplanes.

Fascist Germany's treacherous attack on our motherland prevented completion of all of the planned material, technical and organizational measures. But on the whole, what had been done to reinforce and develop the air force before the war created the necessary foundation for Soviet aviation's successful conduct of active combat operations. The following fact is a particular confirmation of this: In less than a month—from 22 June to 19 July 1941—the fascists lost 1,284 warplanes on the Soviet-German front.

With the inception of the Great Patriotic War the party and government initiated an enormous organizational effort aimed at mobilizing all forces for the defeat of the fascist invaders. Colossal efforts were made to increase production of airplanes and armament. Owing to the selfless labor of the Soviet people, and to the courage and heroism of military airmen, who entered into the struggle in an extremely complex situation, our air force wrested the initiative from the hands of the enemy as early as during the battle of Moscow, exploited their initiative in the skies above Stalingrad and the Kuban, and in aerial engagements above Kursk they achieved

strategic supremacy in the air and maintained it until the end of the war. Soviet fighters and bombers were distinguished by good flying and fighting qualities, and the legendary Il-2 was rightfully recognized to be the world's best attack aircraft.

The collectives of special design offices headed by S. Ilyushin, A. Yakovlev, S. Lavochkin, A. Mikoyan, V. Petlyakov, A. Tupolev and others made a great contribution to the development of Soviet aviation. The work of aircraft engine designers V. Klimov, A. Mikulin and A. Shvetsov also deserves a high score. The motherland takes pride in those who created top-class aviation equipment.

During the Great Patriotic War pilots in frontal aviation and in long-range aviation flew over 3 million sorties. Courageously and bravely fulfilling their combat assignments, Soviet airmen contributed many unfading pages to the heroic history of the USSR Armed Forces.

The motherland was cognizant of the true merit of the acts of heroism of its valiant fliers. Just during the war alone, around 200,000 Soviet airmen were awarded orders and medals, 2,420 pilots were given the Hero of the Soviet Union title, 65 persons earned this lofty title twice, and A. Pokryshkin and I. Kozhedub did so three times.

Our Great Victory promoted creation of a favorable foundation from which to avert attempts by imperialist forces to impose their will on other states and peoples of the planet. It must be emphasized at the same time that creation of the antifascist coalition during World War II provided an example of cooperation between states with diametrically opposed systems and resulted in a joint search for and implementation of mutually acceptable decisions and effective actions in behalf of the triumph of a just peace for all nations, in the interests of a firm peace.

In the postwar period the ruling circles of the USA, which held a monopoly over atomic weapons, actively initiated preparations for war against the Soviet Union. Aggressive military doctrines and conceptions were developed for this purpose. They called for unleashing and conducting global and limited nuclear and other wars against the USSR and its allies. Implementing new militaristic programs, the USA is presently laying special hopes on SDI. Increasing its military preparations, it is counting on achieving military superiority over the USSR. Clearly our country would never allow this to happen. "...while the Soviet Union is not making any demands for greater security, it will not settle for less," declared Comrade M. S. Gorbachev in the Political Report to the 27th CPSU Congress.

The USSR is compelled to combine its peace-loving policy with constant concern for ensuring dependable protection of the accomplishments of socialism. "Be on guard, protect the defense capabilities of our country and

our Red Army as you would your own eyes..." urged V. I. Lenin. The need for this stems from the harsh lessons of the Great Patriotic War, from today's complex situation in the world, from the presence of nuclear missile weapons and large air and naval forces in NATO bloc countries and other imperialist states. And as long as international reaction encourages the arms race, as long as it refuses to reject its policy of social revenge and its "crusades" against socialism, emphasizes the Appeal of the CPSU Central Committee to the Soviet People in Connection with the 70th Anniversary of Great October, the CPSU and the Soviet government will do everything necessary to keep the defensive power of our country and of the entire socialist fraternity at the needed level.

The air force is alertly serving its combat watch together with the other branches of the Soviet Armed Forces. Owing to the constant concern of the party Central Committee and the Soviet government they are outfitted with complex equipment and weapons. Missile-carrying airplanes are the foundation of their fighting power today. Helicopter gunships have also proven themselves to be a mighty and effective resource. Helicopter crews can successfully destroy missile and artillery emplacements and tanks, annihilate manpower and knock out airfields and other enemy objectives.

Soviet aviation is the cradle of cosmonautics. Yu. Gagarin has already been followed into space orbit by more than 60 valiant sons of the fatherland and representatives of countries of the socialist fraternity and other states. As Comrade M. S. Gorbachev emphasized at a meeting with workers of the city of Leninsk, "...everything at the cosmodrome, beginning with the highly complex launching facilities, test stands and laboratories and ending with the powerful launch vehicles, spacecraft and their life-support systems, equipped with modern computer technology and highly sensitive instruments, is Soviet-made, high quality and technologically up-to-date."

One of the main important tasks posed by the CPSU Central Committee and the USSR minister of defense to air force personnel today is that of maintaining constant readiness to engage in aggressive and decisive combat activities.

Implementing the decisions of the 27th CPSU Congress and of subsequent CPSU Central Committee plenums, military airmen are focusing their efforts on raising the quality of combat and political training and of their aerial, fire, tactical and special skills. In this training year, in this year of the 70th anniversary of Great October, formalism, stereotypy, laxity and simplifications in the organization and preparation of tactical flying exercises, sorties, lessons and training exercises are being uprooted decisively.

Restructuring of the activities of military personnel is proceeding on a wider front in air force units and subunits. It is directed at raising combat readiness and

improving the process of personnel training and indoctrination. Commanders, political organs, staffs and party organizations are striving to create a situation of high exactingness and of maintaining high principles, and to raise party responsibility for high quality fulfillment of assigned tasks.

To organize the training and indoctrination in relation to modern standards of quality means first of all conducting every lesson, tactical flying exercise, training exercise and every flight shift at a level corresponding to the requirements of the development of military science, combat equipment and weapons, and at the level of the best procedures. We must strive for a high level of organization, discipline and a conscientious attitude toward the work, and develop the initiative and creativity of the personnel.

In our restructuring effort we will not be able to successfully solve the complex problems associated with increasing the fighting potential of the air force unless we erect a strong barrier to subjectivism, mediocrity and the race for quantity at the expense of the combat skills of the airmen. The main thing is to utilize every training hour and every sortie in the interests of raising the proficiency of flying personnel, engineers, technicians and specialists in service and support subunits, so that the measures carried out within the unit would be oriented on improving the flying, fire, tactical and technical skills of the airmen.

In the effort to support the high combat readiness of the units and subunits, much depends on the commander, on his professional training and competency, on the moral and fighting qualities of the personnel, on their personal initiative and on a searching assessment of their work and their skills. The January (1987) CPSU Central Committee Plenum emphasized in particular: "The Central Committee is firmly counting on army personnel and on the Soviet officer corps in solving the problems of strengthening the defense capabilities of the state, and it is certain that in today's complex international conditions communists and all army and navy personnel will act with the greatest responsibility, that they will elevate and improve the proficiency and combat readiness of all arms and services."

The results of the last training period and the organization and course of combat and political training in the air force indicate today that wherever commanders adhere to the tested principle of teaching the troops that which they need in war, and actively develop and introduce new forms and methods of operational-tactical, technical, fire and air training, wherever they persistently improve training procedures and comply strictly with the laws of flight service, combat training proceeds in more organized fashion, its quality is higher, and a dependable barrier is maintained to flying accidents and near-accidents.

The air force devotes constant attention to improving the moral and combat qualities of military airmen, to tightening military discipline and to maintaining firm order. A purposeful effort is being made to improve the training material and equipment base. Creative use of our priceless legacy—the combat experience of the Great Patriotic War—is playing an important role in meeting these goals. Steadfastness and courage, valor and fearlessness, the ability to fight a well-trained adversary, proficient handling of complex combat equipment and weapons, a strong will to win: All of these qualities of wartime airmen are also being absorbed by today's generation of pilots, navigators, engineers, technicians and other air force specialists.

The military labor of many of them has been honored by awards of the motherland, and those who distinguished themselves the most in the performance of their military and international duty in the Democratic Republic of Afghanistan have been given the Hero of the Soviet Union title. This high honor has been awarded to military pilots V. Pavlov, V. Gaynutdinov, Ye. Zelnyakov, N. Kovalev, V. Kucherenko, A. Levchenko, N. Malyshchev, V. Ochirov, V. Pismennyy, P. Ruban, S. Filipchenkov and V. Shcherbakov. Their example of high ideals and responsibility, of occupational proficiency and self-sacrifice, of initiative and creativity, of bravery, of personal discipline and closeness to subordinates inspires young fliers to storm new summits in improving their occupational skills.

Today, noting the positive changes in the lives of many military collectives in the air force, and making a searching assessment of what has been achieved, we cannot ignore the omissions and shortcomings that have not yet been corrected in the organization of the training and indoctrination of military airmen. People are not yet acting everywhere in the spirit of the restructuring effort, or supporting their words with energetic and concrete practical deeds, or decisively surmounting inertia and eradicating the mechanism of inhibition and of old habits and approaches. We sometimes hear people say: "It's hard, it's difficult, there are not enough trainers or time...." As a consequence certain units and subunits still condone simplifications in the organization of combat training and conservatism practiced with the purpose of reducing the risk of failure in combat training.

Some commanders and staffs are restructuring their work style too slowly, they are avoiding pressing problems, and sometimes they are simply reluctant to assume responsibility. As a result the work suffers, the quality of aerial skills declines, and confusion arises with personal and material support. This affects the moral atmosphere in the collective and the results of military labor. Owing to neglect in the performance of assignments in complex, extreme conditions and in major tests of occupational proficiency and moral and psychological strength, the people do not always pass

their tests, and they receive unsatisfactory grades. Such things happened in the past in the collectives in which officers A. Zubarev, V. Kolbasko, G. Gorchakov and N. Lysenko serve.

Attitude toward restructuring and actual work done are the decisive criteria used to assess the activities of military personnel today. The moral countenance and competency of the officer-leader, his high professionalism and his adherence to everything that is new and progressive are acquiring enormous significance.

A new moral and psychological atmosphere is forming in air force units and formations in the course of the restructuring. The activities of military personnel and their capabilities for successfully completing the complex tasks associated with maintaining constant combat readiness are being reevaluated. It is not enough today for a leader to recognize the shortcomings and flaws in personnel training and indoctrination and to document them: He must do everything energetically and decisively to prevent their existence.

It is important to reinforce that which has been achieved, to impart stability to positive trends and to mobilize military airmen for high quality fulfillment of their missions. This requires honest and selfless labor and high inspiration from all. We need to constantly, decisively and persistently improve the activities of the staffs and intensify their control over the course of the flight training of the airmen and its planning, organization and conduct.

The ability to organize the work on a scientific basis, active utilization of the accomplishments of modern military scientific thought and high competency in tactics and operational art are qualities that are very necessary of every officer today. A nose for the new, high professionalism and responsibility for assigned work are acquiring great significance in today's conditions.

Socialist competition, which has developed this training year with the slogan "Fulfill the Decisions of the 27th CPSU Congress, and Mark the 70th Anniversary of Great October with Selfless Military Labor!", has become a tested means of upgrading the quality of combat skills, indoctrinating air force personnel and developing initiative and a creative approach to organizing the training process.

Commanders, political organs, staffs and party and Komsomol organizations are obligated to utilize the high patriotic enthusiasm of the airmen elicited by the preparations for the jubilee of the Great October Socialist Revolution with the purpose of improving party-political work and the occupational skills of the airmen, of raising the combat readiness of air formations and units,

and in order to achieve complete and high quality fulfillment of the complex and important missions associated with dependably protecting the accomplishments of socialism.

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### Civil Aviation Restructuring Its Work

91440420b Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp 5-7

[Article by Col Gen Avn A. Volkov, USSR minister of civil aviation, USSR distinguished military pilot: "On the Course of Restructuring"]

[Text] The 70th October is moving along confidently throughout the country, which is being transformed by the selfless labor of the Soviet people. Airmen in civil aviation, who are measuring their works up to the requirements of the party's 27th Congress and the January and June (1987) CPSU Central Committee plenums, are also contributing what they can to our society's revolutionary renewal.

If we compare the results of the past half year with the state targets we would find that the sector is fulfilling its plan rhythmically. During this period over 50 million passengers and hundreds of thousands of tons of national economic cargo were transported, and crop dusters processed tens of millions of hectares. The qualitative and quantitative indicators of production activity improved somewhat, chiefly owing to more sensible use of the aircraft fleet, reduction of relative fuel consumption and growth of labor productivity.

But it is too early yet to talk about fundamental changes. Aeroflot is only at the start of the long route mapped out for the 12th Five-Year Plan, and it has not yet attained its cruising altitude. The sector's restructuring is only just beginning. Even the obvious reserves of restructuring—discipline, organization, the quality of flight preparations and conduct—are being utilized far from fully.

There are many problems that are holding back the rate of development of civil aviation. We will need to work hard to solve them. The example in this great and complex effort must be made chiefly by the leaders, political workers and communists in civil aviation. CPSU Central Committee General Secretary M. S. Gorbachev emphasized the following at the 27th CPSU Congress: "There is no such thing as a vanguard role for communists in general: It is expressed in practical deeds."

Those who are now piloting Aeroflot airships on our country's routes and on international lines, which extend into 98 countries of the world, and those who prepare airplanes for take-off and keep the crews right on course during their thousands of kilometers en route have a place to go to learn the things they need. The calendar of Soviet civil aviation is in its 65th year. In this time,

extremely rich experience was accumulated in all directions of the work of the complex air transport mechanism, and glorious labor traditions were formed.

Vladimir Ilich Lenin was present at the inception of our country's aviation. Laying a firm foundation for its construction in the difficult times of devastation and famine, from those now-distant 1920s he managed to discern the important role that the air fleet would play in the transformation of the country's economy, science and culture, and in development of the international ties of the world's first socialist state.

Red military pilots came from the fire of the battle to restructure our life and from the fronts of the civil war to peaceful work in the sky. There were N. Ilzin, the first to take up aerial combat against farm pests, K. Dedushchenko, commander of the first "Dobrolet" airplane in Arkhangelsk, I. Voyedilo, who flew beyond our motherland's borders, and Ya. Moiseyev, who opened Aeroflot's first regular line. The first heroes of the Soviet Union—M. Vodopyanov, I. Doronin and M. Slepnev, who earned the motherland's highest distinction in 1934 for the Cape Chelyuskin rescue—took their place in the glorious constellation of Soviet civil pilots. N. Shebanov was recommended for aviation by V. I. Lenin. He was the first in Aeroflot to fly a million kilometers accident-free, for which he was awarded the Order of Lenin.

It is in many ways owing to such people and to their effort, courage and highest occupational proficiency that by the end of the 1930s the USSR Civil Air Fleet became an important component of the country's unified transportation system and assumed a leading place in the world.

The legacy of the heroism of civil aviators was continued into the years of the Great Patriotic War. They participated in all major operations, and the 10th Guards Air Transport Division of the Civil Air Fleet saw the end of the war in subjugated Berlin. Many subunits of the Civil Air Fleet became Guards units and received honorary names. Fifteen of the best pilots were given the Hero of the Soviet Union title. A. Gruzdin, D. Yezerskiy, P. Yeromasov, G. Taran, P. Mikhaylov, I. Ryzhkov and many other remarkable pilots, navigators, flight mechanics and technicians were entered into the chronicle of the history of civil aviation in perpetuity.

The friendship between military and civil aviators grew even stronger during the terrible years of struggle with fascism, and it is being multiplied today. Relying upon the rich experience of the air force and the best pilots of Aeroflot, in short time the civil aviation collective mastered the Tu-104, and by the mid-1950s it began regular flights aboard this aircraft, pioneering the era of jet passenger transport on the world's airlines.

The major accomplishments of our country's air transport were subsequently associated with successful introduction of new types of airplanes and helicopters. A new

generation took up the glorious traditions of the pioneers of the air routes, of the participants of the Great Patriotic War, and of the pioneers of jet passenger transportation. This new generation introduced the wide-body Il-86 to the airlines, which is now flying to many Soviet and foreign cities. The ranks of the heroes of the Soviet Union and heroes of Socialist Labor, of recipients of the Lenin and State prizes, and of distinguished USSR pilots and navigators are growing larger. It is especially important today to make fuller use of the experience of the veterans and of the energy of the young to solve the major problems posed by the party before the sector in the 12th Five-Year Plan.

Civil aviators expect to be successful in the restructuring effort, and they have reason to feel this way. After all, there are thousands upon thousands of remarkable laborers among them today. It is with pride that we speak the names of our delegates to the 27th CPSU Congress—pilots of the Moscow Aviation Center Il-86 commander A. Kaledin and Tu-154 commander G. Sheremetyev, Tu-154 commander N. Ozhiganov from Irkutsk, Tu-154 pilot-instructor R. Melkonyan from Yerevan, aircraft technician and brigade leader I. Kornilov from Yakutsk, USSR Distinguished Pilot G. Sarymsakov, an Uzbek Il-86 commander, and other aviation workers known to the country.

Aeroflot possesses well-trained personnel. Nonetheless we need a new approach in work with people. Energetic steps are being taken to restructure the work style of the sector's governing board and executive staff, and to educate and raise the responsibility of every aviator for his work—from the rank and file to the production commanders. Expansion of glasnost, development of criticism and self-criticism, openness of plans and decisions, unity of word and deed—this is the true path toward improvement of the moral climate in the labor collectives, and an effective resource in the struggle against violations of discipline and flight laws. These violations are committed by people owing to low responsibility for fulfillment of official duties. We need to shift the focus of political indoctrination into the crews, brigades and shifts, and augment the educational and leadership role played by airship commanders, brigade leaders and shift chiefs.

Unfortunately there are still many valid complaints about the services provided to airline passengers. This important area of work requires constant and persistent attention. On some summer days up to 600,000 persons fly airplanes, and we need to exert all of our effort to see that not a single passenger would leave an airport insulted or disappointed. After all, even the most insignificant lapses in passenger service do considerable moral harm to Aeroflot's prestige.

The effort to restructure the sector is developing in the conditions of a strict, fundamental assessment of what has been achieved. We need to significantly renew the sector's structure and its economic mechanism in order

that they would provide maximum support to fulfilling the complex production tasks associated with building, expanding and rebuilding airports and agencies, making sensible use of allocated resources and improving the excellence of passenger service. This requires time, and the passenger cannot wait.

The role of the airplane and helicopter in the country's economy is not limited simply to passenger and cargo shipments and to aviation's use in rural areas. Aeroflot performs dozens of tasks—from participation in geological exploration and provision of medical services to the public, to aerial photography and nature conservation.

Clear, rhythmical, highly productive work in the sector depends in many ways on acceleration of scientific-technical progress, on creation of new, improved airplanes, helicopters and ground equipment, and on further mechanization and automation of production processes to ensure high safety and regularity of flights and the excellence of passenger service.

Aeroflot is preparing for the advent of new equipment. New, comfortable and, what is very important, economical aircraft will appear on the airlines in the near future. Their design embodies the latest accomplishments of science and technology and flying experience.

A creative union with aviation industry is being built on the principles of high mutual exactingness and close cooperation in solving the fundamental problems of raising flight effectiveness and safety.

Nor will passengers utilizing local airlines be left unattended. A new Czechoslovak aircraft, the 40-passenger L-610, will join the 17-passenger An-28. Specialists of the Special Design Office imeni S. V. Ilyushin are also working on the Il-114 for local routes. The An-74, which rides on wheels and skis, which is capable of operating from primitive airfields and which can fly a considerable distance will appear in the Far North. New members are also expected to appear in the helicopter family.

The future looks good, but time waits for no one. New airplanes and helicopters, air traffic control resources and convenient air terminal complexes are needed by our national economy, and chiefly by passengers, right now. Aeroflot workers feel it is their professional duty and civic vocation to provide selfless service to the Soviet people.

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### Aviation Industry Reports Progress

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7-8

[Article by USSR First Deputy Minister of Aviation Industry A. Gerashchenko: "The Summits of Aircraft Builders"]

[Text] In the course of socialist development our country transformed into a mighty industrial power with a huge economic and scientific-technical potential. Today it possesses a developed aviation industry with modern production, scientific research and experimental bases providing for the development and production of comfortable, reliable passenger airplanes and helicopters for Aeroflot and perfected warplanes and helicopters for the USSR Armed Forces.

The restructuring going on in the country is a further development of the idea of October, an important element of the mechanism raising the Soviet economy to the highest level of effectiveness and scientific-technical progress. Aircraft builders face highly important tasks today—upgrading the quality and economy of their products, and creating aircraft that not only satisfy the requirements of world standards but also surpass them.

Soon after the victory of the Great October Socialist Revolution, in January 1918, V. I. Lenin pointed out that "socialist Russia must have its own air fleet...", emphasizing its significance as one of the greatest accomplishments of our century.

In June 1918 a decree of the Council of Peoples Commissars nationalized all aviation enterprises, and half a year later the Central Aerohydrodynamics Institute (TsAGI) was created on Professor N. Ye. Zhukovskiy's initiative and with V. I. Lenin's cooperation. This institute subsequently transformed into the largest center of aviation science, and in the future it served as the basis for organizing other scientific research institutes of aviation industry. The Soviet school of aviation designers and scientists, who made a great contribution to the development of aviation, was formed in TsAGI.

An aviation tekhnikum was founded in Moscow in 1919 to train engineers and technicians. Later on it was reorganized as the Military Air Engineering Academy, which became the forge of aviation personnel and which played an important role in the development of the air force. Many academy graduates became prominent designers and organizers of aviation industry.

The general direction for development of Soviet airplane building was selected in the early 1920s—creation of all-metal airplanes, which was essentially a reflection of the general revolutionary approach to technical policy. Soviet aircraft designers A. Tupolev, A. Yakovlev and N. Polikarpov created airplanes of original design—bombers, fighters and reconnaissance aircraft. A number of

long-distance and intercontinental flights were carried out by Soviet airplanes equipped with Soviet engines and equipment. Thus the flight of a crew consisting of V. Chkalov, G. Baydukov and A. Belyakov aboard an ANT-25 from Moscow over the North Pole to America, the 50th anniversary of which was celebrated by our country this year, showed to all the world that the Motherland of October possesses not only bold and courageous pilots but also dependable aviation equipment. Responding to the party's appeal to fly higher, faster and farther than anyone else, Soviet aviators set over a third of all world aviation records in the prewar years.

Several new design offices were created in the late 1930s, in the face of the impending threat of war. A. Yakovlev, S. Ilyushin, V. Petlyakov, S. Lavochkin, A. Mikoyan and M. Gurevich, and other talented designers developed new types of warplanes. LaGG-3, MiG-3 and Yak-1 fighters, the Il-2 attack aircraft and the Il-4 and Pe-2 bombers, which were equipped with fabulous engines designed by V. Klimov, A. Mikulin and A. Shvetsov, were created and tested on an extremely tight schedule. But for the moment they were supplied in limited quantities.

At its inception the war demonstrated not only the great scientific, technical and technological possibilities of USSR aviation industry, but also its mobilization possibilities, which were very important. In the extremely difficult conditions the aviation enterprises moved into the country's eastern regions where they resumed series production of warplanes. By as early as the first half of 1942 the industry was able to surpass its prewar production level. In the first year and a half of the war the aircraft plants provided the front with over 35,200 airplanes; they provided around 35,000 in 1943, over 40,200 in 1944 and around 20,900 airplanes in the first half of 1945. Production of Yak-3, Yak-9, La-5 and La-7 fighters, and of Il-2 attack aircraft, which were superior to all other aircraft in the world at that time, grew especially quickly. By summer 1943 Soviet aviation was superior to German aviation in qualitative and quantitative respects, which made it possible to achieve strategic superiority in the air. A total of 20 airplanes and 23 engines of new types were placed into series production during the war.

Concurrently the TsAGI and the special design office conducted research aimed at creating equipment based on jet propulsion. This work expanded considerably following the Great Patriotic War. In the postwar period the scientific research institute and the special design office of aviation industry initiated development of different types of jets. They had to solve complex problems associated with aerodynamics, with the strength and flexibility of structures and with creation of new materials and special equipment. Jet fighters, bombers and passenger airplanes distinguished by good flying and tactical characteristics were created in short order. The

Tu-104 became the world's first passenger jet. After that the Il-18, An-10, An-22, An-24 and Tu-114, which were equipped with economical turboprop engines, appeared on Aeroflot lines.

Improved warplanes and passenger airplanes of a new generation were developed for military and civil aviation in the 1960s. More-economical Tu-134, Tu-154, Il-62 and Yak-40 passenger liners appeared on the airlines. Continuing to improve aviation equipment and to raise its economy and dependability, aircraft builders created the new Il-86 and Yak-42 passenger jets and the Il-76 transport aircraft.

The An-124 "Ruslan" transport aircraft became an outstanding accomplishment of Soviet aircraft building. It set 20 world records for carrying capacity (up to 170 tons at an altitude of 10,750 m) and range (20,150 km on a round-trip route).

Aviation industry completed an important national economic task—it created aviation not requiring airport facilities. A new sector of the industry appeared—helicopter building. Helicopters with good technical flight characteristics such as the Mi-1, Mi-4, Mi-6, Mi-8, Mi-10, Mi-24, Mi-26, Ka-26 and others were developed and introduced into series production. They are widely used in different regions of the country, and they have set two-thirds of all world records for helicopters, including the records of lifting a load of 40 tons to a height of 2,000 m (the V-12 helicopter) and a load of 25 tons to a height of 4,060 m (the Mi-26). New, more-economical helicopters with improved equipment were developed.

Soviet aviation equipment has been demonstrated successfully at various international exhibitions, and Soviet airplanes and helicopters are exported to many countries of the world.

During a recent friendly visit of a Soviet fighter squadron to Finland foreign specialists gave a high assessment to the technical and flight characteristics of these aircraft.

Today aviation industry is working on a new generation of highly economical passenger airplanes and helicopters. Aeroflot will soon get the Il-96-300 long-distance passenger airplane, which will be capable of carrying 300 passengers a distance of 9,000 km, and the Tu-204, a new passenger airplane for medium-range airlines, intended to carry 200 passengers for a distance of 2,400-4,000 km.

The Il-114, a new turboprop passenger airplane, is being developed for local airlines. New aircraft will enjoy wide application—the Su-26M aerobatic airplane, a training-sports helicopter, and a light multipurpose helicopter.

Research is being conducted on new promising directions in aircraft building that may materialize in the sky of the 21st century. For example a local passenger airliner with turbofan engines, high-capacity transport airplanes and helicopters, and a supersonic passenger airplane.

Much attention is being devoted to improving aircraft production procedures. Aviation industry has mastered cathode-ray welding of parts with a complex cross section, high-speed plasma welding of straight-seam stainless steel and titanium alloy tubing, precise isothermic stamping of compressor blades and many other production methods that raise the strength characteristics of aircraft.

Successes in metallurgy and aviation materials (ultra-light aluminum-lithium alloys, laminated and composite materials, alloys with a memory for shape) are not only making it possible to lighten structures and raise their strength and dependability, but they are also providing a possibility for improving the aerodynamics of airplanes.

Aviation industry possesses remarkable personnel. This is its principal merit. Our experienced and young personnel, engineers, technicians and office workers are distinguished by high ideology, professional competency, the desire to find new solutions to modern scientific and technical problems, and devotion to their beloved work. Fulfilling decisions of the 27th CPSU Congress and of subsequent CPSU Central Committee plenums, they are capable of supplying all of our country's aviation departments with the most up-to-date aircraft.

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**Tactical Possibilities Determined by Mathematics**  
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in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp  
8-9

[Article by Maj Gen Avn G. Molokanov, doctor of technical sciences, professor: "How Many Tactics?"]

[Text] In combat, a pilot tries to make full use of the possibilities of his airplane or helicopter, to correctly account for the situation when executing his mission, and to win. Naturally he uses various tactics for this. In one case they may be successful, while in another case they may not. Why are tactics sometimes insufficiently effective? Where do the difficulties of developing and using them lie? How great is their diversity? What, finally, do we define as an optimum tactic, and how do we find it?

These questions constantly arise in the practical activities of aviators and of their commanders and chiefs. To answer them, we will examine the basic methodological principles that lie at the foundation of tactics. Tactics are

optimum when the actions of the crew in the air produce maximum success in a combat assignment. This is achieved by utilizing all available forces, or minimum forces. Consequently when developing optimum tactics we need to either achieve a maximum result in a mission with fixed forces, or minimize the needed forces in relation to a prescribed result of actions.

This is where mathematical optimization methods—linear, nonlinear and dynamic programming—make their mark. And although strictly speaking mathematics precludes stating a problem such as "attaining a maximum result with minimum forces," nonetheless the problem may be formulated in this way in real experience. But a number of difficulties arise in this case.

Developing tactics is a creative business that does not yield to the strict analytical algorithms for searching for an answer that we find in mathematics. Uncertainty associated with incomplete data on the tactical situation and on possible actions by the enemy also has a great influence. To solve these problems we need to somehow "clear up" this uncertainty. This is usually done by introducing hypotheses that make up for the lacking information. The deeper the knowledge of the enemy and of his weapons and tactics, the more plausible are the hypotheses, the lower is the uncertainty, and consequently the better the tactics would be.

Conflicts in the requirements on tactics generate their own difficulties. As an example to successfully surmount enemy air defenses the aircraft must drop to minimum altitude, but this makes piloting more complicated and jeopardizes flight safety. This conflict is resolved by adopting one flight factor as the main thing and treating the rest as constraints. Consideration of these constraints reduces the number of tactics, because if the possibility that losses may occur in real combat exists, a tactic which threatens certain losses as early as in its developmental stage can in no way be deemed suitable. Thus optimum tactics must ensure maximum effectiveness of actions and exclude losses both due to both the effect of enemy fire and violations of safety rules.

Is there a large diversity of tactics that meet the requirements of sensible actions in the air when the constraints are observed? Calculations show that there are quite a few of them. Herein lies one other difficulty in developing the optimum variant. To answer this question more precisely we will try to conditionally divide a combat sortie into a number of elements characterizing the ways in which the crew works in the air. This would require determining the flight route and profile to the target and back, the number and composition of different tactical groups and the methods by which the combat formation takes off and forms up, and selecting the weapons, the maneuvers by which to surmount air defenses en route to the target and back, the radioelectronic warfare resources to be used, the means of approaching the target, finding it and attacking it, and the method by which the group disbands its formation and makes it

landing approach. These elements are basically what determine tactics. We will stipulate in this case that tactics will be said to be different if they differ from each other at least by one of the elements named above.

In real conditions, several alternatives may be found for some elements, while in other situations a given variant may turn out to be the only one possible—for example the most sensible attack resources, as determined by the nature of the object of the actions.

We can use the following formula to determine the number of possible variants of a tactic:  $N=mn$ , where  $n$  is the number of elements in the tactic and  $m$  is the quantity of alternatives in relation to each element, given the condition that their number is equal in relation to each specific element.

Then in the case under consideration here and given the assumption that each element presupposes three possible solutions, we get  $N=3^{11}=177,147$ .

It follows from this that given the enormous diversity of the variants of tactics, the air warrior or group is allowed considerable freedom of action and the possibility for avoiding stereotypy in tactics. But when we select the final solution we must not dwell on secondary details, because this would cause sharp growth in the number of possible variants, which would make it much harder to find the optimum variant.

Nor is the other extreme permissible, where a small number of elements are examined and all reasonable alternatives of each of them are not considered (recall that their number is the exponent). The result of this approach is that important elements are dropped from the overall order of action in the air, and the set of variants decreases dramatically, such that an optimum tactic may be lost as well. Clearly this would significantly impoverish tactics. Restriction of the number of elements and the quantity of reasonable alternatives is a manifestation of the unwitting tendency of an aviator that is poorly trained in tactical respects to reduce the difficulty of his task. But in essence not only this difficulty but also the number of variants decreases. Thus if in our example we examine only 10 elements instead of 11 by limiting ourselves to two rather than three reasonable alternatives for each of them, the number of variants of the tactic would become equal to  $N=2^{10}=1,024$ .

The choice is doubtlessly simplified, since 116,123 possible variants are dropped out of the running.

Considering that this is a creative process, we could hardly offer recommendations applicable to all cases concerning the reasonable number of elements out of which a tactic is formed and concerning the reasonable quantity of alternatives for each of them. Much depends

on the situation, on the completeness of data on it, on the mission to be carried out, on the tactical training level of the pilots and on other factors.

It is important to emphasize that every element, and especially the reasonableness of its alternatives, must correspond as fully as possible to the situation in which the mission is to be carried out. This is why we need to adhere strictly to the rules of writing war plans: Planning should be carried out in detail only in relation to those conditions which are either well known or which are associated with variants that may be validly and reliably predicted.

When uncertainty is at its highest, such that the possibility of prediction is precluded, it would make little sense to offer "reasonable" variants of action in the plans. It would be better to invest some effort on the ground and in the air to acquire the lacking intelligence upon which correct selection of actions would depend. The ability to instantaneously and accurately estimate a situation, to arrive at the best variant and to carry it out quickly is an important component of the tactical thinking and flying proficiency of aviators—especially of commanders leading groups into combat or controlling the actions of their subordinates from a command post.

The need for considering many variants does of course complicate the search for optimum tactics. Given the uncertainty of the situation, development of optimum tactics is a creative and very difficult task, one requiring mastery of special rules that play the role of methodological recommendations. These rules can regulate both the creative approach and military logical analysis of the path by which a solution is reached. The enormous number of possible variants of a mission does not at all mean that a commander must sort through and analyze all of them, and then select a one and only, most suitable variant. The presence of numerous variants is but evidence of the inexhaustibility of the commander's creativity, and it is a direct requirement of a creative approach to executing important missions.

Selection of a particular variant of combat activities presupposes a profound knowledge of special procedures by means of which a solution that would account sufficiently completely for the most significant factors of the combat situation and make an enormous amount of calculations unnecessary can be found. But that is a special topic of discussion having to do with methodology.

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### **Air Force Peoples Control Groups Need Improvement**

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pp 10-11

[Article by Lt Gen Avn Yu. Fotinov, deputy chief, air force political directorate: "Higher Effectiveness of Peoples Control"; first paragraph is AVIATSIYA I KOSMONAVTIKA introduction]

[Text] "The CPSU will actively promote growth of the effectiveness of state and public control. It views the work of laborers in organs of people control as an important form of development of their political maturity and activity in protecting national interests and instilling a state approach to work and an economic attitude toward national wealth."—From the CPSU Program.

The Basic Law of the Soviet state obligates every USSR citizen to protect and strengthen socialist property, to fight misappropriations and waste, and to multiply national wealth through his own conscientious labor. This constitutional requirement is becoming a matter of duty and honor, one of life's principles, to increasingly larger numbers of Soviet people.

Growing democratization of the socialist structure and measures aimed at activating the work of soviets of peoples of deputies, trade unions, the Komsomol and peoples control adopted by the 27th CPSU Congress and the January and June (1987) Central Committee plenums are opening up broad possibilities for the participation of the masses and of each individual in the affairs of the country, including in the effort to increase the efficacy of the principles of economization—an important factor of intensifying the economy and confirming the principle of social justice. But everything that has been done and is being done now must be evaluated by the yardsticks not of yesterday and even today, but rather by the scale and complexity of new tasks. This is why it is especially necessary today for political organs, party organizations and all communist executives to pay persistent attention to the activities of peoples controllers and to activating their efforts everywhere in the spirit of restructuring.

Public patrols have recently started exercising their expanded rights more fully, and censuring violations of discipline and socialist legality, and abuses of official position.

Preventive work and inspections are improving. More and more often the raids and inspections are integrated in nature, and the controllers are working jointly with internal inspection commissions. An effort is being made to encourage active party and Komsomol members and experienced specialists from different services to participate in such measures.

It is very important to devote increasingly greater attention to the priority problems typical today of air units. As an example the efforts of the active members of the peoples control group headed by Captain S. Denisjuk are directed at economization of material resources consumed per unit of combat use and per flying hour. Owing to higher planning quality, integration of combat training exercises and the careful attitude of aviators toward national wealth, last year the collective's outlays of the life of ground equipment were decreased by 4 percent in relation to every flying hour, and 4 percent of the allocated fuels and lubricants were economized.

The peoples control group of which Lieutenant Colonel N. Khmylnin is the chairman is also having an effective influence on improving flight training. It interacts closely with specialists of the navigation, air engineering and other services and with support subunits. The active members are checking the plans for flying and ground training, the use of objective monitoring resources, the quality of the maintenance of aviation and special equipment, the procedures by which the causes of accidents in the air are revealed and accounted for, and the work done to prevent them.

Public patrols supplement their control functions by educational ones. They regularly speak to the personnel about the need to observe flying laws and to maintain an economical attitude toward equipment and military property, and they inform the aviators on the results of raids and inspections.

The activities of peoples control organs directed at raising the effectiveness of scientific research, at revealing unutilized laboratory and test equipment and at achieving sensible expenditure of materials and equipment have improved somewhat in air force institutions and schools. Take for example the group headed by Colonel V. Kuznetsov, which did a great deal to refine the list of the needed laboratory and test equipment. As a result over 40,000 rubles worth of unneeded and worn apparatus was disposed of.

Take care of the kopecks and the rubles will take care of themselves, as they say. A graphical and persuasive confirmation of the wisdom of this saying can be found in the end results of the work of our best peoples controllers and their numerous helpers. We are economizing significant amounts of money, materials and energy as a result of their activities. For example last year aviators of just the collective in which Colonel A. Shilov is the chairman of the committee for peoples control saved around 10,000 tons of aviation fuel, over 500 tons of motor vehicle fuel and more than 600,000 kilowatts of electric energy. The total savings exceeded 800,000 rubles here.

The struggle against misappropriators of military and state property and against pilferers is becoming increasingly more merciless. Thus peoples controllers of the group of which Lieutenant Colonel A. Mikhaylov is the

chairman revealed cases of misappropriations by warrant officers V. Linnik and V. Veremeychuk. They were both severely punished. Owing to the alertness of active members of the group headed by Lieutenant Colonel A. Igonin, a case of misappropriation of gasoline from a POL dump by Lieutenant V. Kurzayev was revealed, and illegal actions of Junior Sergeant of Extended Service N. Shabalov and Soviet army worker V. Karyakin were averted.

In a word, the peoples control organs of air force units, formations, institutions of higher education and services and of aviation repair enterprises are taking an ever closer look at the main tasks of the aviation collectives and actively seeking ways to make their contribution to restructuring educational, organizational and economic activity, and chiefly to the effort to reinforce combat readiness and military discipline, to ensure flight safety and to strengthen economization.

Nonetheless despite the fact that certain positive changes have occurred in the activities of peoples control organs, on the whole this work is being restructured too slowly. The payoff from their work is clearly insufficient in many directions, and the organs far from always orient themselves on the end result. They are not showing adequate persistence in improving combat readiness and ensuring careful maintenance and operation of aviation, motor vehicle and special equipment, weapons and ground flight support equipment. Such shortcomings and mistakes were noted in the work of the peoples control groups headed by officers L. Borisenko, V. Pavlishin and Ye. Udovik.

Leaders and active members of peoples control organs often see only the general goals and tasks associated with ensuring accident-free flying, increasing their influence on the quality of equipment operation and maintenance, tightening production discipline, utilizing objective monitoring resources and improving the training material base. They rarely delve into, as an example, the causes behind slow construction of housing, airfield structures and training ground buildings. The facts indicate that even an important area such as rear support to flying sometimes slips from the attention of the people who are called upon to stand an alert guard. As an example substandard fuel was used in flying nine times last year in the collective in which Officer A. Timoshchenko serves.

Serious cases of personal hardships were revealed in this collective as well. Moreover many of them were not revealed until communist Officer V. Kozodayev described them in a letter to higher authorities. In the meantime the peoples controllers avoided these important problems, paying little attention to building and repairing housing, stores, nurseries, day care centers and so on. I would like to once again recall in this connection that concern for people is a direct responsibility of peoples controllers.

For the moment the activity of peoples control organs in practically implementing requirements of the CPSU Central Committee and the Soviet government and directives of the USSR minister of defense and the commander in chief of the air force on intensifying the struggle against mismanagement, waste and unearned income is still low. We cannot say today that all channels of misappropriation, embezzlement and squandering of state resources are reliably closed in the air force. Nor are cases of loss of military property eradicated in air units. Of special concern is the fact that misappropriations and squandering are sometimes discovered in places where peoples controllers had already been.

The patrols are also unenthusiastic in the struggle against inflated reporting and falsification of reports. Padding of flying time reports and cases of alterations of weather data in reporting documents with the purpose of fulfilling training plans and programs and obtaining monetary rewards and with the purpose of confirming class qualifications have been documented in certain air force units of the Far East, Transbaikalia, Carpathian, Volga and Siberian military districts. Moreover, acceptance of and payment for unfinished production was discovered in the aviation repair enterprise in which Lieutenant Colonel V. Shulga heads the peoples control group. Efforts to correct shortcomings in providing personnel with authorized clothing and equipment, improving the personal and leisure conditions of the aviators, organizing the work of military trade enterprises, widening the assortment of goods and improving services to customers in aviation garrisons are proceeding far from smoothly. The priority of concern for people was dropped in the units in which officers P. Ivanov and P. Sharikov serve and in some other military collectives. We cannot condone such a state of affairs.

Restructuring the activities of peoples control organs presupposes deep analysis, objective conclusions and extraction of objective lessons for the future. This pertains both to the patrols and to those that guide their work.

Thus in the air force, it was revealed in some military districts and groups of forces that cases of excessive expenditure of aviation fuel in certain units and subunits due to higher operating time of airplane and helicopter engines on the ground and unmindful use of heat engines are concealed behind the average, generally favorable indicators for economization of fuel and lubricants. This can be explained also by a superficial approach to economization in the troops, and by the fact that economization of fuel and lubricants is graded by "eyeballing" in some formations and units, depending on how much is left over. And those people who have the responsibility for maintaining order do not always notice manifestations of the purest formalism.

Sometimes it is difficult to persuade the driver of a fuel truck or an aircraft mechanic to save a liter of kerosene during refueling when hundreds of kilograms and even

tons of fuel are spilled before their eyes due to violations of the planning table and lack of coordination in the work of different services—that is, due to problems that depend on flight planning and organization.

Some peoples control organs do little to help commanders and party organizations to write a specific, clear program of personal economic work for each soldier. Despite the measures that are being implemented, the movement "For a Subunit of Thrifty Soldiers" is not being developed actively enough in a number of units and formations.

One of the principal reasons for low effectiveness of the work of certain peoples control organs is their insufficiently effective management. Military councils, commanders and political organs have not yet been able to get all managers to deeply understand their tasks in the effort to restructure the activities of public patrols. Cases have occurred where peoples controllers are refused support by commanders and chiefs, and where executives have ignored public opinion and covered shortcomings over. Guards Captain A. Markin, the chairman of the peoples control group of a certain air garrison, reported shortcomings in the work of the aircrew dining hall and dining hall director V. Lushnikova, revealed by inspections, to unit commander Guards Lieutenant Colonel A. Volkovinskiy on several occasions. But no steps were taken in response to the findings of the patrols, and not a single order punishing those to blame was ever published in the unit on the basis of the results of raids and inspections. Higher organs had to intervene before proper order could be restored in the collective and normal conditions for the work of peoples controllers could be ensured. Communist A. Volkovinskiy was subjected to party punishment.

Many commanders and political workers understate the importance of public control as a real force capable of not only revealing shortcomings but also effectively promoting their correction. Not all party committees and party buros delve deeply into the activities of peoples controllers or severely punish communists who perform the collective's important assignments poorly.

Mistakes in party leadership of the organs of peoples control are reflected in the work style of the latter as in a mirror. A confirmation of this can be found in cases, unfortunately not isolated ones, where groups and posts plan and carry out inspections in regard to fabricated issues rather than in response to instructions of the appropriate executives and complaints from the grass-roots level. Such inspections are not distinguished by depth and meticulousness, they are not very effective, and they are not oriented on correction of shortcomings.

And apparently it is no accident at all that many cases of misappropriation, abuse of official position, padding of flying hours and other illegal actions are revealed not by peoples controllers but by procuracy organs, by letters written by aviators to higher authorities and to the editors

of newspapers and journals, and when materially liable persons accept and surrender their posts. This approach is no good; we need to fundamentally alter the psychology of noninterference and the wait-and-see attitude.

The weakest link in the air force peoples control system continues to be the groups that sometimes remain too distant in their inspection and preventive activities. The activity of peoples control posts in many military collectives is found to be low. Aviators elected to them hardly ever try to instill a sense of economy in the personnel, and they are too timid in their efforts to encourage soldiers to maintain constant and universal control over legality and order.

The work of peoples controllers lacks glasnost. Personnel are informed of inspection results in isolated cases, and the results of raids are sometimes published obscurely, which doubtlessly reduces their educational effect. Positive work experience and analysis of mistakes and failures are still rarely shared among all peoples control organs. Decisive changes are needed in this area as well.

Mistakes in the activities of patrols can also be explained by the fact that sometimes people who are not always capable of revealing mistakes and abuses owing to their insufficient life and work experience are selected for groups and posts. It must be made good and clear to those who are entrusted with such an important area of public work that passiveness is harmful to the cause, that they cannot limit themselves to simply documenting the shortcomings. It is important to achieve their complete elimination, and to achieve real changes for the better. Such is one of the principal requirements of restructuring. "Dismantling stagnant forms, methods and habits is never easy," it is emphasized in the appeal of the CPSU Central Committee to the Soviet people in connection with the 70th anniversary of Great October. "We must fight for restructuring, we must defend restructuring. What we need here is stubbornness, firmness and clear principles. We also need character and self-sacrifice." This pertains fully to our public patrols.

Great reserves for accelerating solution of the problems facing the air force can be revealed by activating the work of peoples control organs. We can utilize these reserves effectively only by raising the work of the committees, groups and posts to a level corresponding to the party's present directions and by achieving substantial end results from their activities. Life demands that the contribution of air force peoples controllers to the restructuring process be more noticeable and substantial, so that their activities would produce a continually growing payoff in the struggle to upgrade the quality of combat and political training, to achieve flight safety, to tighten discipline and organization and, in the final analysis, to achieve high combat readiness of air formations, units and subunits.

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### Stories of the Air War in Afghanistan

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[Article by Hero of the Soviet Union V. Kot, military pilot-sniper: "Courage and Proficiency"]

[Text] Afghanistan.... It has already been several years that the forces of counterrevolution and international imperialist reaction have been waging an undeclared war here, striving to halt the process of positive changes begun by the April 1978 revolution. Soldiers in the limited contingent of Soviet troops, who came here as internationalists, as faithful, sincere and disinterested friends, are providing invaluable assistance to the Afghan people in defending against external aggression and the intrigues of overthrown classes.

Every sortie here requires high occupational proficiency of the aviators, will, self-control and the readiness to act immediately in a dramatically altered situation. The absolute majority have displayed remarkable flying and fighting qualities, eliciting delight and pride.

I remember the time when a pair of Mi-24s headed by Captain S. Nikolayev were circling over the mountains, providing cover to Mi-8s that were dropping off a new shift at posts perched on isolated summits along the Panjsher drainage. The work was already coming to an end when concealed dushman opened intense fire on the helicopters in the vicinity of the last post. Nikolayev noted the source of the fire, immediately gave his orders to his follower, and then attacked first. He made his strike, followed by the second crew. As the lead helicopter recovered from its dive, it was peppered by machine-gun rounds. Something happened to the control system.

Sheer rock walls were to the left and right, and the bottom of the ravine was hidden in a blue-gray haze 3 kilometers below. The helicopter was on the verge of autorotation. The situation seemed hopeless. But the pilot quickly regained control. It was a good thing that the craft was pointed in the direction of the airfield as it recovered from its attack. This was something the pilot could capitalize on. He set the speed in such a way as to neutralize the turning moment and, trying to control the helicopter with a jeweler's precision, he guided it along the ravine. The rest of the crews followed him, providing cover to him against possible strikes by the bandits, though of course mostly to provide moral support to the pilot.

Nikolayev finally emerged from the rocky trap, but even so, the rest of the trip was not easy. True, the officer was now sure that he would make it to the airfield. But he was not clear as to how he was to land the helicopter. He had

never experienced such a situation before. He could not slow the helicopter down to landing speed because it would begin to turn. This meant that he could land only at higher speed.

Coordinating his actions with the flight leader, Captain Nikolayev guided his craft in for a landing. As soon as it touched the landing pad he immediately switched the propulsion unit off. Even so the helicopter began turning. The pilot did his best to keep it moving straight. The helicopter hopped over a trench, leaped over a section of rough ground, barely missed a vehicle and slipped by other obstacles. Then finally it slowed down and stopped.

Finding himself in an extremely difficult situation, Captain Nikolayev emerged the victor, bringing his combat helicopter down intact. None of the crewmembers were hurt. The pilot's bold, confident, truly proficient actions quite naturally became the topic of detailed study in the subunit.

And how can we ever forget military pilot 1st class Major S. Pryanikov! His act of heroism amazed even those who themselves experienced many difficult trials in the Afghan sky. This is the way it happened.

The subunit was dropping off a tactical airborne assault landing force. Major S. Pryanikov was proceeding to the target area with the assault force aboard. The ridge on which the detachment of motorized infantrymen were to be landed came into view. The pilot took the helicopter down. The front and left side supports had barely touched the granite when a dushman fire position came to life on the opposite hillside. The bullets damaged the control system. Flames licked the helicopter's skin. The assault troops were not yet out of the cargo hold. Sergey Donovich could feel the helicopter begin to list, and he put all of his effort into keeping it upright. At this moment no task was more important to him than making it possible for the motorized infantrymen to disembark safely. He thought nothing of himself and of his own safety.

The moment the last soldier left the helicopter a powerful explosion occurred on the right side, and a tongue of fire intruded into the pilot's compartment, its heat scorching the pilot's face. Major Pryanikov managed to shout to the crewmembers: "Bail out!" Then he moved the left canopy aside and thrust himself out of the helicopter as it rolled into the chasm.

The pilot was evacuated soon after by a pair of helicopters led by flight commander Captain V. Fedchenko. The officer suffered serious burns over his face and body. A person of tremendous courage and inflexible will, he risked his own life to save others. Even while in the hospital Sergey Donovich thought not so much about himself as about his comrades: He asked if all the soldiers had managed to disembark, and how the navigator and flight technician were doing.

Yes, fulfilling their military and international duty in the Democratic Republic of Afghanistan, our aviators display boldness, courage, valor and outstanding occupational proficiency essentially in every sortie. They possess bonds of kinship with those who fought for the young Soviet republic during the civil war, and with those who defended the motherland in the struggle with the fascist invaders during the Great Patriotic War.

It is with agitation that I think about military pilot-sniper Communist L. Fursa. The leader of an aviation collective, to his subordinates the officer was an example of initiative and persistence in the performance of combat assignments and in proficient actions over a target. Here is a typical case.

In the vicinity of the huge rebel base of Maru, located in the border zone, reconnaissance discovered a dushman caravan that was preparing to evacuate into Pakistan after hard battles with subunits of the Afghan army. Its withdrawal had to be cut off. And the weather was unstable.

Leonid Petrovich decided to take charge of the fighter group. He selected the strongest pilots. They made the necessary preparations and took off into the cloudy sky soon after.

In short time they were over the target area. The mountains rose around them, their summits hidden in the film of clouds. Getting to the target was very, very hard, but Fursa led his group without faltering. He was the first to discover the large caravan near a pass. Stunned by the sudden appearance of the fighters, dushman opened random fire on them. Selecting the correct direction, Fursa led the group into the attack. He dropped his bombs, and his followers followed suit. The intense bombing and strafing attack decided the fate of the caravan. Fursa's group destroyed it, annihilating many dushman.

I should emphasize that the weather conditions were complex. Very few pilots could have completed their task in such conditions. But it was within the means of pilot-sniper Officer Fursa and the aviators of his group. And not only owing to outstanding proficiency but also owing to deep awareness of their duty and of their great personal responsibility for the sortie's success.

The next day fate put them to another test. This time Leonid Petrovich, who was flying in the lead position in his flight, discovered a camouflaged dushman weapon and ammunition depot on the floor of a deep ravine in inaccessible terrain. "It would be natural for the depot to be heavily guarded," he reasoned. "It would not be all that easy to approach it." Despite the great risk, Fursa boldly led his group to the target. Performing a precise maneuver in the ravine, he rushed into the attack, urging

his followers on behind him. As the flight recovered from its dive, powerful explosions of the bombs they dropped rocked the ravine. The huge ammunition depot was annihilated.

In his time with the limited contingent of Soviet troops in Afghanistan Leonid Petrovich flew over 370 combat sorties. Most of them involved serious tests of will, courage, endurance and proficiency. The officer displayed the full measure of these remarkable qualities. His talents as the leader of a military collective and as an organizer of tactics that were unique in concept and bold in their execution widely revealed themselves as well. Under Fursa's guidance new methods of using fighters in mountainous terrain were actively developed, utilization of the airplane's precision characteristics was improved, and coordination with helicopter crews and with ground troop subunits was perfected.

Whenever Fursa left on a combat assignment, he did so with the awareness that he may encounter mortal danger. But he never vacillated, he was always prepared for all surprises in the air. And in many ways it was perhaps precisely his strong fighting spirit that saved him in one flight which demanded exceptional courage and self-control.

At dawn a group of two flights headed by L. Fursa took off for a bombing and strafing attack on the highly fortified rebel base of Dzhavara [transliteration], 20 kilometers south of the population center of Khost. As it maneuvered for its bombing run Leonid Petrovich's fighter was hit by a Stinger missile launched by the dushman. Smoke trailed a long distance behind the airplane. The damaged fighter resisted control, and it was on the verge of exploding at any moment. But bailing out over the region of combat activities was equivalent to capture by the dushman. At this critical moment the pilot displayed coolness and self-control. Dropping his bombs on the dushman, he positioned the wings for the greatest lifting force and pointed the burning fighter toward the nearest airfield, hoping to reach it and land there.

But the situation grew more complex with every second. Before he could reach the airfield the airplane went completely out of control: It was impossible to keep the craft from turning, even with two hands, and Fursa ejected. He was injured as he abandoned the airplane.

At the same time that the second flight was attacking the rebel positions his follower, the deputy commander for political affairs, and the second pair of this flight consisting of Major V. Nedbolskiy and Captain V. Tur, stayed right with Fursa all the way. The pilots followed him, communicated the necessary commands, and when he landed beneath the canopy of his parachute they began circling his position with their guns blasting, providing cover to their commander against dushman trying to break through until the arrival of the search and rescue helicopter.

Later on when I interviewed Leonid Petrovich he spoke of his comrades-in-arms with glowing terms. I listened to him, and I felt proud of this officer, I was filled with admiration for him. Communist Fursa had committed a real act of heroism. He had been awarded the Order of the Red Star earlier, and now he was given another completely deserved high state decoration.

I could keep going about many of our other pilots who took part in the effort to provide international assistance to the people of Afghanistan. Here in Afghanistan, heroism has become a routine, daily thing to most of them. People of a new postwar generation, they are faithful to the banner of October, just like the defenders of the revolution during the civil war and the Red Army soldiers and commanders in the Great Patriotic War. They are wholly devoted to their military and international duty, ensuring that they will experience further accomplishments in their military service to the Soviet motherland.

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11004

### **Bomber Crews Need Challenging Training**

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in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp  
17-18

[Article by Guards Lt Col N. Kuprikov, regiment senior navigator, military navigator 1st class: "On a Bombing Mission"]

[Text] Operational flights are an exceptionally important stage in the occupational training of flight crews. In them, especially if they are conducted in complex weather, aviators acquire the habits of effectively using weapons in a situation as close to that of real combat as possible, and they form important qualities such as boldness, decisiveness, resourcefulness and psychological steadfastness, without which there can be no victory in real combat.

It is the features of operational flying in complex weather that I would like to discuss.

Flying to a target in clouds is unique in that the crew focuses its attention chiefly on the screen of the radar sight in its relationship to piloting and navigation instruments. One of the decisive factors of successful completion of a training mission is the navigator's ability to get the airplane precisely to the target area at the appointed time and to find the aiming point on the onboard radar screen.

Experience persuades us that the work of the crew becomes significantly more complex when the target is approached in dispersed combat formations. The problem is that piloting and orientation in space in the absence of visual contact with the ground, the limited

time for working the cockpit controls and maximum concentration of the attention of the aviators create high psychological tension and require exceptionally clear and coordinated actions of the pilot and navigator. The needed qualities and habits may be acquired only in the course of regular training, on the mandatory condition that a creative attitude is maintained toward the training. Any manifestation of stereotypy in the performance of operational missions does harm not only to the flight training of the crews but also to flight safety.

At one time the squadron headed by Guards Lieutenant Colonel V. Ryabov maintained high indicators in combat training. The actions of the aviators in tactical flying exercises were distinguished by boldness and originality of thought. The flight crews had sufficient experience in attacking targets from different directions day and night in adverse weather. The quality of their tactical flying was good. One would have thought that they would continue to grow, that the personnel would be encouraged to conquer new summits in military work. But things went in the opposite direction.

The intensity of the flight work in the subunit gradually decreased. Standard routes came to be used more and more frequently on the practice range, and the flights became stereotypic, their purpose reducing to simply maintaining previously acquired habits. The bitter fruits of the collective's self-satisfaction ripened quickly.

During a certain operational readiness inspection the squadron had to attack targets on a training range unfamiliar to the pilots from three directions. Despite the fact that the crews knew exactly where the training targets were, and that the weather was good, they completed their assignment with extremely modest results. The pilots and navigators that received the lowest scores tried to justify their mistakes—not enough time to prepare for the sortie and the complexity of the approach to the training range.

These were nothing more than empty excuses. It was revealed in the critique that a lack of experience of the crews in operational flying and absence of experience in preparing for sorties in rigidly limited time—that is, in a situation as close to one of real combat as possible—were the main causes of the low quality of the assignment's results. Had the weather been poor on that occasion, I think that failure of the mission would have been a real threat.

This case served as a bitter lesson for all of us. It was analyzed in detail in all of the military collectives, and it was discussed at party meetings. The opinion of the aviators was unanimous: Breaks in operational flying and laxity in training are impermissible. They have a deleterious effect on the tactical and gun-handling proficiency of the flight crews, and consequently they do

harm to all combat training. It was also noted that it is much easier to keep the training process from going off track than to get it back on track once it has been derailed.

As I mentioned earlier, the navigator plays a significant role in bombing missions carried out in adverse weather. The sighting and navigation system installed in our airplane significantly raises the accuracy and dependability of navigation and tactical use, freeing the crew of cumbersome calculations and releasing more time for responding to surprises arising in tactical missions. But we must not forget this golden rule: Count on the high reliability of the sighting and navigation system, but don't make any mistakes. This is why navigator training should be oriented primarily on imparting the abilities and habits of using the sighting and navigation system.

From my point of view the squadron in which Major V. Rachkov serves has accumulated valuable experience in navigator training. Experienced instructors have been gathered together here to teach the young navigators. Their fast development is promoted by an entire complex of measures including regular generalization and study of the experience of the best aviators, effective utilization of training equipment, interesting and instructive theoretical lessons, and purposeful independent study. For example some navigators including lieutenants V. Maltsev, K. Kuzmin and A. Nesvit are now capable of performing bombing missions successfully in cloudy skies not only during the day but also at night.

But we are not resting on our laurels. This year we received some green replacements from the Chelyabinsk Higher Military Aviation School for Navigators. Capitalizing on the accumulated experience, we assigned the best-trained mentors to the lieutenants, and we tried to create the necessary conditions in the subunits to ensure that the young navigators would be broken in well.

Nonetheless we are not yet to the point where we avoid mistakes completely. Failures sometimes occur owing to inadequate experience in flying in adverse weather and because of tension and constraint the aviators feel in the air. This has a negative effect on the skill of the entire crew.

During a certain flight a crew headed by an experienced pilot had to conduct a bombing mission in cloudy skies. The missile carrier assumed its bombing run at the appointed time. Lieutenant K. Kuzmin, the navigator, identified the target trace on the radar screen, carried out all of the elements of the aiming procedure and flipped the right switch at the required moment. The pilot squeezed the trigger, but the bombs did not disengage from the pylons. It was not until he switched off the bombing system that the navigator noticed that the mounting configuration switch was in the wrong position.

Doubtlessly Lieutenant Kuzmin was chiefly to blame for the incident, inasmuch as he failed to set the switch in the needed position. I think that the pilot should also be reprimanded for failing to monitor the navigator's actions. Lack of coordination in the work of the crewmembers was in fact the cause of the mistake.

Assumption of the bombing course, as well as the bombing run itself, should be strictly scheduled for the crew, and it should be thought out beforehand to the finest details, so as to preclude the need for any last-minute adjustments, save those that are extremely necessary to the bombing mission. From my point of view proper organization of flight critiques plays a major role in attaining such high coordination in the actions of the crewmembers. Considering this, we try to set up flying shift critiques in such a way that they would be instructive to both young and experienced aviators. Our best pilots and navigators—officers I. Yermenko, V. Krasnikov, N. Soldatov, A. Kuzin, V. Metsker, A. Pozdnyakov, N. Abramov, V. Somsin, Yu. Polezhay and P. Gavrillov—share their experience generously.

Organizing the training process, we try to constantly remember that excellent results can be achieved in combat training only when laxity and simplifications are completely excluded from daily work. This is why we are waging a decisive struggle against such shortcomings in the interests of constant combat readiness.

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11004

#### Qualities Required of Flight Control Groups Discussed

91440420h Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp  
22-23

[Article by Maj V. Surov, official flying officer: "In the Center of the 'Zone of Responsibility': Discussion of the Article 'The Sky Does Not Pardon Mistakes'"]

[Text] An important aspect of accident-free flying is touched upon in Lieutenant Colonel V. Antyufeyev's article (AVIATSIYA I KOSMONAVTIKA, No 1, 1987)—flight management. I would like to share my thoughts on this account, and relate the positive experience of our unit's flight control group.

Our flying goes on in a dynamic, tense situation. The tasks become more complex and important with every training period. And it is very important to carry them out without accidents and near-accidents in the air. This is precisely what the commander and party organization orient specialists of the flight control group on.

The success of efficient flight management depends to a decisive degree on how well the training of persons in the flight control group for the performance of their responsibilities is organized, and on how control over their activities is set up. The main requirements imposed on them are spelled out in documents regulating flying. And the experience of the best specialists shows that only strict fulfillment of the corresponding provisions of these documents can guarantee that the quality with which tasks are completed is high and that flying is safe.

There is no need to discuss the training system of the flight control group—its stages are the same as those undergone by aircrews. Everything is clear as a bell here, as they say. But something must be said about the attitude of some specialists of the flight control group to improving their knowledge. No one is about to debate the importance of training exercises. We cannot do without them. But something odd happens: On reaching a certain level of proficiency, certain specialists tend to view training as a burden. They take their place in the trainer, sit there for a minute or two and then shrug it off: Why should I waste time here? I've been through this many times before, and it's all clear to me.

A certain psychological property of the human character makes itself known in such cases. We admit to ourselves that we tire of, and sometimes even become irritated by, frequent repetition of the same actions, and in some way we subconsciously try to avoid them. Some manage to suppress this desire, and force themselves to work, while others limit their training or avoid it entirely.

I feel compelled to cite my colleagues Major Ye. Goloskov and Captain V. Arapov in this regard. When they are in charge of flying, everyone is confident of its favorable outcome. These officers have no special secrets. Principled and responsible, they never deviate from the laws of flight service, and they constantly improve their knowledge not only in the course of planned assignments but independently as well.

Work typical of a flight shift was proceeding at a certain command dispatching point. The call signs and short messages of the pilots could be heard from the speakers in a continuous flow. Flying officer Major Ye. Goloskov communicated by radio with the crews in strict succession, separated them in altitude, guided them to the practice range and determined the maneuvers they would need to take to make their landing approach. The planning table lay before him like a musical score. Working like a conductor, he competently controlled the mighty flying "symphony" competently from his console.

Everything was proceeding in accordance with the plan worked out during the day of preliminary preparations. Then suddenly the radio came alive:

"This is One Five One, I have an instrument failure!"

This did not catch the flight control group unawares. Goloskov immediately gave instructions to Captain V. Arapov:

"Bring him in."

"I see him..., I have control..., " the flight leader replied crisply. And he guided the helicopter crew precisely into its landing corridor in altitude and lateral deviation.

Competent and effective management of a flight shift naturally requires, besides deep theoretical knowledge, firm habits. As we know, they are acquired and reinforced in practical work with training equipment. Only systematic, properly organized training exercises can produce a high level of thinking and actions. They provide a possibility for quickly recovering and then improving habits that have been lost for one reason or another, for working out new and difficult exercises and actions in special cases most completely, for analyzing and correcting mistakes, and for checking the feasibility of planning tables.

Flight control is figuratively speaking the center of the zone of responsibility marked out for the leader of the flight shift. It is the focal point of constant concern for the entire process of development of the aviators, for their safe work in the air. But this does not limit his official responsibilities. No function occurs in our collective's daily schedule without the participation of Major Goloskov.

Take for example drawing up the planning table for a flight shift. Being well aware of the training level of each pilot and navigator, during days of preliminary preparations he takes a direct part in drawing up this important document together with commanders and instructors. Major Goloskov always carefully analyzes mistakes made in the previous shift. This makes it possible to understand the training level of the aviators better, and during the flying it provides a possibility for quickly assessing different situations and advising the air warriors how to extricate themselves from a given difficult situation. Perhaps the main thing here is that the flight leader does not simply document deviations in flying and then read off the facts in flight critiques; instead, he takes specific steps, he fights to keep mistakes from happening.

Here is an example. Once Captain V. Soldatov was late in reporting to base that he had reached the end point of his route. This caught the attention of the flight leader. He made a note in the crew's log, reported the incident to the commander and made sure that it would be thoroughly analyzed.

As they analyzed the incident they revealed that the crew was guilty of more than just a simple oversight: While flying in clouds they made a mistake in selecting their reference point and, moreover, they determined their

flying speed incorrectly in the last phase. Thus by pulling on a single thread they unraveled the entire ball: They revealed weak points in the crew's training in navigation.

Navigator training exercises were conducted at the recommendation of experienced teachers. In them, the aviators worked out the methods of determining a helicopter's location using radiotechnical resources when visibility is reduced by clouds. In addition a check flight was planned for Soldatov.

Here is another example. An experienced pilot making his landing approach failed to report passing a long-range homing beacon. The flight leader was the first to notice the mistake. The conclusion was that this incident was caused by the helicopter commander's inattentiveness. It was analyzed with all the personnel participating. And to keep the same thing from happening again, the pilots reviewed the rules of radio communication and underwent practical exercises in distributing attention among the different instruments during a landing approach.

To Goloskov, and to other persons of the flight control group as well, revealing mistakes made by the aircrews is not a goal unto itself. The main thing is to conduct purposeful preventive work, to achieve complete mutual understanding in the "ground-sky" loop. This is why we follow the rule of not simply being present when tasks are allocated, but also participating in the flight planning and in the training. In a word, just like with the flying crews, we need to "work ourselves into" the dynamics of the next shift beforehand. Moreover we must not only actively influence assignment fulfillment and exercise effective control over the actions of pilots and navigators, but we must also be the champions of the tightest discipline and high organization on the ground and in the air, and require the aviators to comply strictly with the rules of flight service. Relax just a little, and all kinds of preconditions for accidents immediately arise.

Here is just one case. Because they were late in fueling their helicopter, the crew took off late. In his effort to meet the planning table at all costs, the flight leader gave the helicopter permission for take-off anyway. The violation of the schedule complicated the situation over the airfield and affected the quality of the exercise results. The helicopter pilot was observed to slow down at the third checkpoint. The flight recorder confirmed the suggestion that he had made the mistake owing to haste. We accepted some of the blame for this.

The flight critique is the most effective form of aircrew training. This is why we prepare for flight critiques with full responsibility. Once again Major Ye. Goloskov, a bearer of the order "For Service to the Motherland in the USSR Armed Forces," 3d Degree, can serve as an example here. When he gives objective grades to his crews, he documents every mistake and accumulates the

necessary material. What he says at critiques is methodologically grounded, specific and instructive. This officer is distinguished by clearly logical reasoning and a sincere interest in raising the effectiveness of combat training.

Here is something else I would like to talk about. Some flight leaders wonder why they need to know the individual qualities of a pilot. That would be within the competency of his immediate commander, they think. But life shows that we must study the character traits of pilots and navigators. This helps specialists of the flight control group to attain complete mutual understanding with them, and it makes air traffic control easier.

Being at the focal point of airfield activities, the flight leader assumes the entire responsibility for an efficient and constant work rhythm. This requires maximum self-control, great diligence and constant improvement of habits. I think that it is precisely on these qualities that the effect of specialists of the flight control group on flight safety depends most of all.

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11004

#### Quick Estimation of Tactical Radius

91440420i Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 87 (Signed to press 3 Jul 87) p 29

[Article by Maj V. Korolkov, military pilot 1st class]

[Text] Modeling different ways to carry out a combat assignment, the pilot turns to an important indicator—the tactical radius for the chosen flight profile and conditions, with regard for the weapon load and other variable parameters. The problem here is that if he changes any one of the parameters, the pilot is forced to recalculate the radius of action.

As time grows constantly shorter, complicated and cumbersome engineering and navigation calculations make decision making more difficult. In this connection quick estimation of tactical radius offers advantages from the standpoint of time and quality of preparation.

Quick estimation is not a new method: It is used successfully in daily combat training and in command-and-staff exercises. But information converted into the form of graphs and transparencies has the one shortcoming that the weapon load, altitude and flight conditions must remain constant. In other words to determine tactical radius in the case of a complex flight profile, the pilot would need a set of such graphs for the different initial parameters (fuel reserve, the weight and drag of external pylons, flying altitude and speed). And the extra calculations these graphs require take up almost as much time as the classical method of calculating the radius.

I suggest using nomograms based on the value of a reference tactical radius pertaining to specific (reference) values of initial parameters such as drag, weapon load and weight, altitude, and flight profile and conditions in different phases of flight to the target and back. Such nomograms make it possible to condense the information, to account for changes in parameters affecting the tactical radius and to determine it with acceptable accuracy.

The nomogram is made in the following way. The values of initial (reference) parameters such as airplane take-off weight, fuel reserve, distance of the home airfield from the front line, external pylons and the flight profile and conditions in different phases of the route are selected in the course of engineering and navigation calculations. The found value of the tactical radius is adopted as the reference radius. In this case the values of the initial reference parameters are optimized in relation to their operating range.

As an example an airplane may carry four mounted fuel tanks. But the fuel reserve equivalent to suspending two mounted fuel tanks from the airplane should be adopted as the reference value for the fuel reserve.

An airplane can carry up to six tons of weapons on its pylons with a maximum drag equal to 100; but a weapon load Delta GWL equal to one ton is adopted as the reference value, since a change in the airplane's weight that affects the tactical radius insignificantly has a significant effect on the airplane's practical ceiling. And a value making it possible to fly to the target at maximum altitude is adopted as the reference value for drag. In this case the weight and the drag of mounted fuel tanks do not enter into the values of Delta GWL and Delta DWL.

Assume that the airplane's home airfield is within 50-200 km of the front line. A distance of 120 km is adopted as the reference value (Saf).

Within friendly territory an airplane flies to its target either at minimum altitude outside the zone of visibility of the enemy's radar, or at the most advantageous altitude,  $H_1 = (Saf/20) - 2$ , with regard for minimum fuel expenditure per kilometer. The most advantageous altitude would best be adopted as the reference altitude.

An airplane can fly over enemy territory within a range of altitudes from minimum to 10,000 m. In this case it would be suitable to adopt, as the reference altitude, that which is close to the lower boundary of the range of surface-to-air systems—approximately 2,000 m, while that for the return trip should be 5,000 m.

Some flight phases over enemy territory will occur at minimum altitude. As an example let us consider an airplane crossing through air defenses in the forward edge of the battle area. It is divided into two sections. The first line of air defenses, the depth of which is SFEBA1=25 km, must be crossed at the maximum

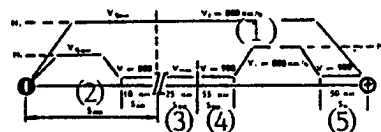


Рис. 1. Схема опорного профиля полета.

Figure 1. Reference Flight Profile

Key: 1. km/hr 2. Saf 3. SFEBA1 4. SFEBA2 5. ST

possible speed for the given version of mounted equipment, while the second, the depth of which is SFEBA2=55 km, must be crossed at 900 km/hr. But when crossing through the target's air defenses, the depth of which is ST=50 km, it would be better to maintain a speed of 900 km/hr.

When there are no SAM sites within the zone in which the front line is to be crossed or in the vicinity of the target, in these phases the airplane flies at moderate altitudes, and SFEBA1, SFEBA2 and ST are adopted equal to zero. That is, they can assume only two values.

Reference velocities in the different phases of the route and other parameters of interest are determined in similar fashion.

A reference flight profile is diagrammed in Figure 1.

The values of the initial reference parameters are: airplane take-off weight  $GTO=18,000$  kg, fuel reserve—two mounted fuel tanks, weapon load Delta GWL=10,000 kg, weapon load drag Delta DWL=40, distance of the airfield from the front line  $Saf=120$  km,  $H_1=(Saf/20)-2=4$  km,  $H_2=2,000$  m,  $H_3=5,000$  m,  $SFL=10$  km,  $SFEBA1=25$  km,  $SFEBA2=55$  km,  $ST=50$  km. Speeds are indicated in the diagram.

Using these values for the initial parameters in our engineering and navigation calculations for the flight, we find a reference tactical radius of  $RRT=400$  km.

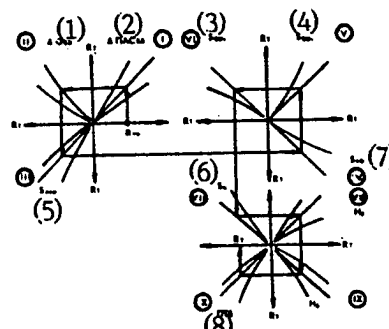


Рис. 2. Вид составной номограммы.

Figure 2. Appearance of Composite Nomogram

Key: 1. Delta GWL 2. Delta DWL 3. SFEBA1 4. SFEBA2 5. Saf 6. ST 7. SFL 8. Mounted fuel tank

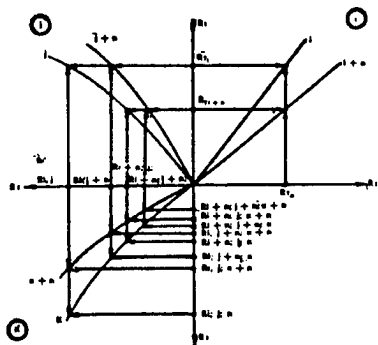


Рис. 3. Порядок построения составной номограммы.

Figure 3. Procedure for Plotting the Composite Nomogram

We find the tactical radius for the specific profile, flight conditions and weapon load using a composite nomogram (Figure 2). The number of quadrants we use is determined by the number of variable initial parameters. We enter the nomogram with the reference tactical radius. Each quadrant is a simple nomogram representing the dependence of the reference tactical radius on one of the initial parameters. The result in one quadrant (except the last) is used to enter the next quadrant.

The nomogram is plotted successively for the individual quadrants, keeping track of the variable initial parameters associated with them. The dependencies of the tactical radius on values of the initial parameter in the given quadrant are plotted on the basis of the results of the engineering and navigation calculations and the initial values (Figure 3).

The composite nomogram determines the tactical radius highly accurately (only graphical error is inherent to it). But it is hard to plot because of the numerous times intermediate values of the tactical radius must be calculated, and due to the large time investment. For example if we consider only the most important initial parameters, such as the drag of the weapon load, its weight,  $S_{af1}$ ,  $H_2$ ,  $H_3$  and presence of the mounted fuel tanks, then the minimum number of variants of the tactical radius is around 225, while their average number is on the order of 2,800. This is why a computer must be used to plot the nomogram.

But there is a simplified procedure by which the nomogram can be plotted. It makes it possible to use a microcalculator for all calculations. In this case the dependencies in each quadrant are plotted separately in relation to two points. Later on all quadrants are integrated into a single composite nomogram. When the nomogram is plotted by the simplified procedure, the dependencies become linear, and while error increases somewhat, the number of times the combat radius has to be calculated decreases to 50-60.

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### Artificial Intelligence Systems Support Aerial Combat

91440420j Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp 38-39

[Article by Lt Col Med Serv O. Baluyev and Sr Lt I. Makarov based on foreign publications: "The Onboard Computer in Aerial Combat"]

[Text] There is no direction in the development of technology, in scientific research and in any form of human activity which aggressive circles of the USA and the bosses of the military-industrial complex would not try to adapt to achieving their own reactionary political goals. A militaristic future has also been prepared in the United States for one of the promising sectors of modern scientific-technical progress—artificial intelligence.

Utilization of the ideas of artificial intelligence is now an important problem of world aviation industry. The concept "artificial intelligence" is applied to a certain direction of research, and it is also the name applied to the systems developed in this direction. In this case a computer is recognized to be intelligent only when it produces results equal to or surpassing the fruits of human mental activity. An artificial intelligence system makes a transition possible from working with quantitative values to working with conceptual categories, which makes it fundamentally different from traditional computers.

A qualitatively new level of development of basic components lies at the basis of practical introduction of artificial intelligence technology, because the volumes of information needed for work with conceptual categories are several orders of magnitude greater than in the case of making calculations. It is anticipated that in the next few years integrated silicon-based systems utilizing 1.25 micron components will make the high speeds required possible. In this case a computer assembled on one board with a volume of 0.2 cubic inches and a weight of 0.23 kg can operate at a speed of up to 4 million operations per second. Later on the speed of high-speed integrated circuits is to be quadrupled, which will increase relative productivity to 27 million operations per second. And this is not the limit. It is reported in the foreign press that the U.S. Air Force has included development and introduction of artificial intelligence technology among its most important directions for the next few years. Thus, the following forms of research are planned: finding dependable examination methods making it possible to systematize and generalize practical knowledge, ideas and assessments; creating artificial intelligence systems capable of computerized vision, speech identification and "understanding" of natural language; developing systems and methods making it possible to accelerate introduction of artificial intelligence and to simplify

specific models equipment with artificial intelligence capability; opening up fundamentally new scientific approaches to computer technology and to the architecture of devices; achieving qualitative advances in micro-circuitry design.

It is believed that systems of onboard electronic equipment developed with regard for the ideas of artificial intelligence will act as pilot assistants. Interaction between specialists in electronics and biology is promoting creation, on the basis of artificial intelligence, of life support systems, devices displaying the information of active control, and special symbiotic complexes.

The control system will take on the job of controlling engine thrust and determining the airplane's attitude. Interaction between the crew and onboard equipment is to be accomplished in natural language. It is anticipated that artificial intelligence would be able to control the quality of imagery on onboard displays: Whenever information perception worsens, the system will synthesize communications distorted by any sort of interference. There are high hopes for capitalizing on the rich possibilities of symbiotic physiological monitoring systems that distribute the load between the pilot and automatic systems. Hardware will assume the task of selecting the priority of task fulfillment and assume the responsibility of completing those tasks which are lower in importance and priority. Decisions will be made in the principal situations by the man-computer system. The computer will not have "control" over joint decisions, but it will retain the "right" to provide warnings when implementation of adopted decisions is impossible or dangerous to the aircraft system. In this case the artificial intelligence apparatus may propose another solution; however, the pilot's approval of any practical action is mandatory.

When he finds it impossible to arrive at a decision, the pilot may transfer the right to do so completely to his electronic consultant. The structure and content of interaction between man and computer are being developed in application to the following types of systems: estimating the situation (the conditions of combat activities, the type of targets, the air defense resources, topography, weather, the person's own characteristics and so on); selecting tactics (recommending tactics, selecting weapons and electronic warfare resources, determining flight route and profile); planning mission fulfillment and proposing mission plans on the basis of the situation; monitoring the status of aircraft equipment and diagnosing the actual condition of the airplane.

According to today's predictions artificial intelligence will also replace the copilot, the navigator and the flight engineer. It is anticipated that such cooperation will raise the effectiveness of the pilot in single-seat aircraft.

Development of the technology by which to transfer aircrew responsibilities to automatic systems is proceeding in parallel with the planning of information display

and control resources based on the conception of maximum generalization of information and reduction of the quantity of manipulations of cockpit controls. There are plans for studying the feasibility of using onboard wide-angle cathode-ray tubes and panel-type indicators (gas-discharge, luminescent, light diode and liquid-crystal). The useful dimensions of the information field may surpass those of existing systems installed aboard the F-18 by approximately 10-15 times. The coordinates of an object on the ground are fed into the onboard computer by touching the appropriate places on the information field, which is mated to a control field. The pilot formulates the task in natural language and uses his hand to transmit the command to fulfill the flight program.

The most optimistic predictions assert that control may be exercised even without language—by thoughts directly. The crew-armament system may become one variant of an "electronic consultant." This idea is to be incorporated in an experimental airplane code-named the ATF. The onboard fire control complex determines the target coordinates, calculates the trajectory of the projectile and transmits an interrogation command. The automatic flight control system, which is mated to an engine monitoring device, takes the airplane to its weapon launching altitude. In the opinion of foreign specialists any future aircraft control method should be combined with verbal and tactile systems and with programmable switches making it possible for the pilot to control the aircraft almost without removing his hands from its controls. Moreover side panels are to be abandoned: All information will be provided on displays in front of the pilot. Thus onboard computer systems will replace at least 90 percent of the pushbuttons and scales. The cockpit of the ATF is being developed to permit display of tactical information in the form of a map that is updated in real time. The evolving situation may be evaluated by means of active interrogation of the onboard expert system's databank (providing information on armament and other combat characteristics of enemy airplanes, digital terrain maps and so on). It is believed that it would be reasonable to employ pilot support programs that limit the information that is displayed on the indicators only to that which is necessary and preprocessed.

Plans have been drawn up for systems based on the ideas of artificial intelligence having the purpose of limiting maneuver of an airplane if its flight conditions attain parameters dangerous to man. Onboard apparatus that measures the pilot's reaction to accelerations is being planned for this purpose. Blood pressure and muscle tone are monitored and the electroencephalogram is recorded automatically. The results are instantaneously compared in the computer, which stores information on the tolerance of the given pilot to such accelerations. If physiological reactions are close to their limit, the electronic "brain" transmits a command to reduce the intensity of maneuvers, even going as far as rescinding commands of the pilot himself.

All of these ideas, conceptions and directions of development are in the exploratory stage. The level of industrial technology does not yet permit mass introduction of aircraft carrying "intelligent computers" into the armies of the NATO countries. But the ideas of artificial intelligence have already been embodied in series-produced equipment for controlling high-power radiation in the radioelectronic countermeasures system installed aboard the B-1B. An expert system that can solve navigation problems has been developed: It can correct flight plans, account for weather changes and change the flight route in response to particular technical failures or due to closure of an airfield. The principles of artificial intelligence are being utilized in the development of models and methods for selecting an optimum flight route in the presence of various limitations. The problem of integral processing of data from different sensors in onboard infrared and radar observation systems, radiotechnical reconnaissance systems and identification apparatus is close to being solved.

There is information that experimental flights of single-seat airplanes have been used to work out the methods of pilot-computer interaction proceeding with reliance on an expert system, and the structure of a pilot's work with information systems as it relates to change in targets and flight tasks in real time. The unique features of the "synthesized" action of a pilot and automatic systems designed to surmount emergency situations and to select scientifically grounded behavior in response to their appearance are being studied in experimental flights aboard the F-16.

Imperialist circles are laying high hopes on computers in their efforts to create military robots. A special agency for long-range defense research was created to coordinate the efforts of scientists and developing enterprises. It is organizing the work of numerous institutions carrying out strategic research on the use of the ideas of artificial intelligence in warfare. There are plans for amplifying the "computer" training afforded to air force specialists: Courses of study on the fundamentals of artificial intelligence theory have been created.

But reports of significant difficulties in creating artificial intelligence are also being leaked out in the press. Information on the difficulties is suppressed, but one way or another the main problems are discernible. Foreign specialists note the high cost of designing, introducing and operating equipment based on artificial intelligence technology; the acute shortage of specialists in this field; the absence of solutions to many fundamental problems associated with development of the relevant components and a dependable expert system; ambiguities in the interpretation of the research directions owing to lack of information on what the problems of artificial intelligence are; difficulties in coming up with exhaustive software for planned and series-produced technical models; the practical unpredictability of the consequences of

crew-computer symbiosis, as it is related to legal responsibility for an adopted or rejected decision; the difficulties a crew may experience in the air if such an active operating system fails; the possibilities for operating aircraft equipment in a combat situation and for servicing it; the problems of selecting and training personnel utilizing such equipment.

At the same time, as foreign experts note, it must not be forgotten that mass introduction of artificial intelligence technology into aviation practice in the NATO countries may cause a significant reduction in the numbers of flying and ground personnel. Such unification of aircraft combat equipment would lead to reexamination of the entire arsenal of the tactics used against ground, water, submarine and airborne targets owing to significant expansion of the combat capabilities of aircraft; growth of the psychological dependence of crewmembers on the technical state of onboard systems; a decrease in the morality and growth of the brutality of personnel, who are relieved of legal responsibility for military crimes in connection with presence of a "thinking" computer aboard.

Specialists feel that the views on conducting combat operations with the assistance of intelligence systems are based on rigid ideas held by the authors of the computer programs concerning the most probable actions of the enemy, and they do not account for the fact that if a pilot reacts in a nonstandard way in combat to change in a situation, the onboard computer may be deprived of information that it could use. Nonetheless the U.S. State Department is investing enormous assets into the development of these systems, which according to the plans should relieve the pilot of the need for thinking in the air, and consequently for acting in accordance with his experience, knowledge and conscience.

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11004

**Air Controller Relates Afghanistan Experience**  
91440420k Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp  
40-41

[Article by Capt S. Sorokin, air regiment command post chief: "I Was an Air Controller"; first paragraph is AVIATSIYA I KOSMONAVTIKA introduction]

[Text] Captain S. Sorokin, subsequently a recipient of the Order of the Red Star, performed his international duty in Afghanistan as an air controller in the limited contingent of Soviet troops. He first heard about this military specialty back when he was a student in military school, but he was not clear then as to what it really entailed. Nor did he even conceive that he himself would

play the role of an air controller. The officer shares his impressions about his time in the Democratic Republic of Afghanistan, and his accumulated experience, in the notes published below.

### Contrasts of the Capital

The Il-76 landed at Kabul Airport. Then we drove through the city. Nothing of what I saw was what I had expected—the blue sky, the hot sun, the mountains, the yellow dust. I had expected seeing a capital with a typical look—tall modern residential buildings, wide streets, billboards. But none of this was there. One- and two-story buildings, and just a few four- and five-story residential buildings. It was hard to pinpoint the city center in its traditional sense. Kabul is a city of contrasts. One can see luxury cars and camels, color television sets and kerosene lamps, and stylish European suits and native dress side by side. But what astounded me the most was that the city is a continuous marketplace. They sell everything and everywhere.

On the background of this peaceful scene one often meets armed people and combat equipment. The country is toiling, and the country is warring—this can be felt right away.

### Combat Traditions

The air controller group was made up of a small, very friendly collective that had already managed to develop some of its own traditions. One of them is that of accepting the weapon of one's predecessor. Replacements accepted weapons from comrades leaving for the motherland.

The breaking-in period began with an apprenticeship, during which the novice was always accompanied by an experienced controller. The first real test of my abilities came during a certain march. An Afghan troop subunit and a Soviet subunit assisting the former had sealed off a certain area. The subunit to which we were providing air support was given the mission of combing the sealed-off area.

The column of infantry fighting vehicles moved through the narrow streets. Suddenly there was an explosion beneath the lead vehicle—it had run over a dushman mine. The explosion was followed by gunfire from inside the huts, from which several grenades were lobbed as well. The fight was on.

I didn't know much of anything at this moment—where they were shooting from, where I was to shoot, and what I was to do in general. Following the short but savage engagement the controller who had been appointed as my mentor said:

"The main thing is that you didn't falter. You'll learn how to fight with time."

I subsequently performed more reasonably, but one interesting thing is that as it turns out, the experiences of a first battle are common to many people. As a rule a person who finds himself in such a situation loses his bearings at first, but this quickly passes. And precisely because some old soldier is always nearby in the most difficult minutes.

### Combat Traditions

Soon after, I left to carry out an assignment on my own.

A large band led by Akhmad-Shakh had taken over a certain canyon. The several thousand well-armed and trained dushman enjoyed direct and continuous communication with Pakistan. The hard-to-reach canyon stretched 120 kilometers from the border almost all the way to Kabul. Dushman caravans infiltrated through this canyon, and many sabotage groups threaded their way through it. This bandit nest had to be destroyed.

At dawn our subunit entered the region of combat activities in order to occupy commanding summits and cover the movement of comrades following us.

For two weeks we fought in the mountains. Every buttress, every ridge had to be taken by storm. The assistance provided by helicopters in these conditions cannot be overstated.

But Dushman bullets were not our only hardship. The mountains, the lack of water, the need to save ammunition and the absence of suitable helicopter landing sites increased the complexity of the combat situation. But never did I hear any complaints from our soldiers, because we all knew that it was our job to provide cover for our comrades.

Soviet pilots were models of bravery and proficiency. They managed to land their helicopters on a single wheel high on the rocky slopes to evacuate casualties, and they made air strikes from the most unexpected directions. My mission as an air controller was to indicate targets and control the aircrews as they landed and took off, to organize the evacuation of casualties and delivery of food, water and ammunition, and to guide the helicopters to enemy fire positions.

It was after these battles that I came to feel that I had become a controller, and that many things were within my capabilities. In a word, I came to trust my own strengths.

### Marches and More Marches

When I returned from one march I learned that a friend of mine, Senior Lieutenant A. Bakhtov, had died a few hours before our return. There were no controllers in reserve, and so I went in his place. The map which I took from my deceased comrade's plotting board was covered with blood, and pierced by a bullet in its upper corner.

This time I was to accompany airborne assault troops that were to knock down the dushman screens, gain control of caravan trails and prevent surviving bandits from escaping into Pakistan. The dushman experienced the full power of the strikes by the Soviet assault troops.

The heavy fighting continued for a month, but finally the mission was completed. A legal government was reestablished in many regions of the Panjsher.

Later on I took part in various marches and in many battles. Frequently we carried out purely peaceful assignments—escorting columns carrying cargo from the Soviet Union, and providing assistance to the local population.

Wherever we went we encountered many friends, and we felt that we could count on them always. Ongoing transformations were visible throughout. Simple Afghans wholly supported the legal government. They greeted their Soviet brothers affably and joyously.

#### **Destined to Be Defeated**

The enemies of Afghanistan are still strong. They are supplied with weapons bearing trademarks of the USA, England, Italy, Pakistan and Belgium. This I saw with my own eyes at captured bandit bases. But reactionary forces are not strong enough to annihilate the April revolution.

In the eyes of the POWs I could see only fatigue, slavish subservience and hatred of those who had befuddled them and sent them out on an unjust struggle. The overwhelming majority of captured dushman were morally broken.

#### **Departure**

A year and a half of flying. I awaited my reunion with the motherland with impatience and joy. Nonetheless it was sad to leave this country, where I left friends behind, where I lost comrades in combat, and where I learned to love and value life.

I left with a sense of having fulfilled my duty honorably. I was sent off at the airfield by my friends—air controllers, helicopter crewmen, assault troops, motorized infantrymen—by those with whom I shared bitterness and joy.

Besides feelings, I carried home the experience of combat, which I would like to share with those who had not attended this harsh school of struggle and life.

I think that the main characteristics of dushman tactics are as follows.

As a rule the bandits avoid battle with relatively large subunits. In such cases they try to evade them and take cover as soon as possible.

The principal targets of attack are vehicle columns, helicopters and airplanes during take-off and landing, isolated groups of servicemen, unarmed persons at resting and overnight halting places, small garrisons and civilian objectives.

Strikes are made most often from camouflaged shelters, simultaneously from several directions by four or five groups including snipers. The groups are armed not only with infantry weapons but also grenade throwers and light mortars. Their favorite places for action are those in which maneuver is difficult: Narrow canyon passages, kishlaks, bridges, trails and roads.

When they attack airfields and garrisons the bandits use mortars and machineguns mounted on motor vehicles. In these cases they change their position after several salvos, and they make their strikes from behind posts and minefields.

The enemy lies in wait for airplanes and helicopters during their landing approach and take-off. Their favorite time of action against aviation is twilight, which lasts a very short time in these regions: Nightfall occurs literally in just a few minutes. And the activity of the bands increases at night.

It should be considered that one of the principal methods of dushman combat activities is "mine warfare." Mines are laid on road shoulders or right on the roads, as well as by wells, in places usually employed as campsites, and wherever personnel appear periodically.

In no case should one drive over boards and boxes on roads, lift them, or approach any suspicious objects—that is, ones found in an unusual place (an ink pen on a road, abandoned bicycles, radio receivers).

When performing international duty, it is important to have a good knowledge of the customs and laws of the host country.

#### **One Other Thing**

Participation in combat activities tempers the individual morally, educates him, and raises the measure of his responsibility for every action, every deed. A person who does not know war, who was educated in the ideals of humanitarianism and brotherhood, is compelled to kill. This is a difficult psychological trial. But when the enemy is before you, there is no time to think: He must be annihilated. Moral and psychological unpreparedness of a soldier may result in not only his own death but also that of dozens of peaceful people at the hands of a bandit who had not been disarmed in time.

Responsibility for one's comrades and for the fate of Afghanistan helps the individual to understand life better. The problems of general policy are perceived more keenly, because they affect the individual directly. Viewpoints on some age-old problems of life change. The

individual becomes purer in spirit. Many negative traits in the characters of people disappear without a trace in a combat situation. The individual reeducates himself, and the more complex the situation is, the faster honesty, collectivism, mutual assistance and boldness are confirmed within him.

Everything good and everything bad manifests itself instantaneously in complex situations. Only Man can become a real warrior. This must not be forgotten for a single minute in the course of combat training in peacetime. This must be a subject of special concern on the part of the officer and the soldier, on the part of the commander and the subordinate. And on the part of the commander especially.

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11004

### **Mir Station Crew Overcomes Mechanical Difficulties**

914404201 Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp 41-42

[Article by Lt Col V. Ulyanov: "Examination in Space"]

[Text] On 31 March 1987 a Proton launch vehicle delivered a fundamentally new structure to space orbit from the Soviet Union—the Kvant specialized astrophysical module. The module was maneuvered in orbit by means of a service unit equipped with a propulsion device.

On the night of 5 April, after carrying out approach maneuvers in response to commands from Earth, the Kvant module rendezvoused with the station. The Igla automatic radiotechnical approach and docking system, which was used with all preceding cargo and manned transport craft, went into operation. In accordance with flight safety instructions Yuriy Romanenko and Aleksandr Laveykin transferred to the transport craft docked to the station's anterior compartment.

Docking of two such sizable masses in orbit requires a certain degree of caution. Approach and the work of the automatic systems of the module and the station proceeded in accordance with the flight sequence diagram.

"Taymyry," flight leader V. Ryumin radioed. "Range 485 meters. The docking mechanism rod is deployed. The television monitor is operating. Everything is proceeding normally."

The module was around just 200 meters from the station when information indicating that the Kvant module had escaped capture and was drifting away reached Flight

Control Center. It would not be difficult to imagine the situation in the main room of Flight Control Center. But all kinds of things can happen. Valeriy Ryumin knew this well.

"Taymyry, look through the porthole and tell me what you see," he instructed.

A few seconds later Yuriy Romanenko replied:

"It's drifting away from us."

"Drifting away. Understood."

"We can see the module behind us against the Earth. It is exhibiting residual velocities."

"Is it rotating?"

"It's rotating a little."

This was followed by reports from the orbit on the probable rotation velocities of the module and the amount by which it had drifted away from the station. This was an unusual situation.

"Relax, Yura, Sasha. We're studying the telemetry, we'll get back to you with the results."

Concentrated, meticulous work was started at Flight Control Center. They had to find a solution to this unusual situation. Everyone was called in—cosmonauts, scientists, engineers, designers, specialists of the Cosmonaut Training Center and of Flight Control Center, and the system developers. Deep and comprehensive analysis of the telemetric information from the module, the crew's report and the results of mathematical calculations revealed the cause of the failure.

When the algorithm for the work of the Kvant module's automated approach system was developed, rigid requirements were included in the permissible deviations in the positions of the objects (course, roll, pitch, approach velocity) in the final approach. This was done for fully understandable reasons—the need for special caution when docking objects of great mass in orbit, and the desire to make the final phase as "gentle" as possible. This was the reason why at a certain moment Kvant lost sight of the Mir station, and why the module control system, which followed a strictly logical work routine, initiated an evasive maneuver and aborted the docking procedure. To solve the problem, the personnel on Earth modeled the different ways that deviations could occur, and using the command radio line aboard Kvant they transmitted information to change the operating algorithm of the automatic approach and docking control system.

During this time the distance between the station and the module had increased to 400 kilometers; also, the module was now forward of the station and above it. It was from this distance that the module and station began their second attempt at approach and docking.

It was the night of 9 April. Mutual search, approach and docking were proceeding in accordance with the standard program.

Time 0414 Hours

"Range 260 meters, speed 1.6 meters per second."

"Parameters are normal."

"Range 215, speed 1.5."

"Angular deviations normal."

"Range 26, speed 0.32."

"Contact!"

"The mechanical lock is engaged. The docking mechanism's drive is on. We have engagement."

A second passed, and then another. Everyone was waiting for those traditional words: "We have lock-on."

"The rod jerked twice in the middle of its deployment," the cosmonauts reported from the Taymyr system.

"The rod has deployed a little short, men, carefully check out the module through the porthole in the transfer chamber. Is the module pitching? Is it oscillating?"

That was it for communication. The complex had left the zone of radio visibility.

In the final phase of mechanical traction of the module to the station, at a distance of not more than 40 millimeters, motion of the rod of the Kvant module's docking system ceased. This meant that electric, hydraulic and pneumatic coupling of the vehicles had not been achieved, and that the process of creating a single space system was not complete. Once again an unusual situation.

And back to analysis of telemetric information, reports from Taymyr, and modeling the situation that had evolved in orbit. All flight tracking services acted efficiently and closely, like a well-tuned machine. The specialists arrived at a unanimous opinion: A foreign body had lodged itself in the docking unit of the Mir station. The crew would have to go out into space.

Such an EVA had not been foreseen by the program. The cosmonauts had not prepared themselves for a spacewalk along the entire station to the docking unit. Ground

control had to provide them assistance in their emergency preparations: It had to explain the methods and procedures of the needed operations.

The situation that had arisen in orbit was reproduced in the hydraulic laboratory of the Cosmonaut Training Center imeni Yu. A. Gagarin. All elements of the forthcoming spacewalk were worked out. The most experienced individuals did the work: USSR Pilot-Cosmonaut L. Kizim, who had spent more than 30 hours in open space, and instructors N. Yuzov, V. Kasatikov, and A. Gusachenko, who trained crews for extravehicular activity prior to flights. The actions to be taken by the Taymyr cosmonauts were rehearsed in detail, step by step.

In the night of 11 April, after the final check of the methods to be used during the spacewalk, a decision was made: The spacewalk was to occur at 2340 hours on 11 April.

Date 11 April, Time 2000 Hours

Yuriy Romanenko and Aleksandr Laveykin began donning their pressure suits and checking their systems. The hatch of the transfer compartment was closed, and its airtightness was tested. Pressure was then released from the transfer compartment. The equipment was tested for airtightness. Flight leader V. Ryumin provided some brief instructions.

"We are now beginning to open the hatch."

Time 2341 Hours

Aleksandr Laveykin reported:

"I'm going out."

And suddenly:

"Pressure is falling."

Everyone in Flight Control Center held their breath.

"Everything is O.K.," the commander reported after helping out his flight engineer.

As it turned out, the flight engineer had accidentally snagged the pressure control knob on the pressure suit as he left the spacecraft. Everything was now shipshape. Pressure was normal—0.38. The spacewalk was resumed. The cosmonauts moved along the station. Soon they reached the docking assembly compartment, having traveled 15 meters.

Date 12 April, Time 0043 Hours

Romanenko reported:

"We are at the edge of the assembly compartment. I don't see any wires stuck in the docking assemblies, but the module and the station are displaced, misaligned."

Ryumin transmitted:

"When the station reaches the Eupatorian zone we will transmit a command to extend the rod—first by 150 millimeters, and then fully. In the meantime you check the condition of the cover plates."

This meant that the distance between the planes of the docking frames of the module and station would increase without breaking mechanical contact between them, and make their detailed inspection possible.

"The rod is moving. Now it's stopped. Now it's moving again. A jolt!" reported Romanenko.

"That's the coupling going into action. We're monitoring everything by telemetry. It will stop in a moment. Sasha, can you reach the joint and shine your light on it?"

"I'm moving in slowly. There's some sort of object in there. Or fabric wound into a braid. I will now try to work it out with my hand spike. It's stuck tight."

Time 0226 Hours

"The work is finished. The docking unit is clean," Taymyr reported. "We've inspected everything—the frames, the cover plates, everything's in order."

"And the object?"

"We couldn't pull it out as a single unit. We tore it into pieces. We can't say anything about it, unfortunately. While our attention was on other things, all of the pieces floated away."

The spacewalk was completed on 12 April at 0320 hours. The vehicles were drawn together in response to commands from Earth, completing their total mechanical, electrical, hydraulic and pneumatic connection into a single Mir-Kvant-Soyuz TM-3 orbiting complex weighing a total of 51 tons.

The unusual situations will be analyzed by specialists in order to correct the problems that brought them about. Things like this will happen in space.

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11004

### Magnetoabrasive Machining Introduced into Aircraft Repair

91440420m Moscow *AVIATSIYA I KOSMONAVTIKA* in Russian No 8, Aug 87 (Signed to press 3 Jul 87) pp 44-45

[Article by Lt Col V. Velikanov and Col V. Kovalev: "Magnetic Field at work"]

[Text] The Basic Directions of the USSR's Economic and Social Development in 1986-1990 and in the Period to the Year 2000 discuss the necessity for widely introducing fundamentally new technologies—cathode-ray, plasma, impulse, biological, radiation, membrane, chemical and others, making it possible to increase labor productivity several times over, raise the effectiveness with which resources are used and reduce the energy and material demands of production.

Making their contribution to solving this problem, air force innovators are striving to make fuller use of the best experience, as exhibited at the Exhibition of the Achievements of the USSR National Economy. As an example specialists of a certain aircraft repair enterprise visiting the exhibition were curious about electromechanical welding (with ribbon, wire and powder materials), which was developed for the first time in world practice for part restoration. This innovation will doubtlessly enjoy wide use. Innovators of another unit picked up many useful things for themselves at the Main Exhibition. In particular they accounted for the experience of using the progressive procedures summarized in this exhibition when they developed a method of magnetoabrasive part machining.

The reliability of aviation equipment depends to a considerable degree on the methods by which the working surfaces of parts are machined in the course of repairs. We know that by imparting the appropriate microrelief to these surfaces we can significantly improve physicomechanical properties as well. But despite the continual growth of machining precision in turning, boring, milling and grinding operations, this work requires considerable outlays.

According to specialists the outlays associated with machining the most complex units and parts of aircraft engines attain 5-10 percent or more of the overall labor cost. In a number of cases, especially that of finishing complexly shaped parts and parts made from modern high-strength materials and alloys, many traditional methods successfully used in the past are totally unacceptable today. In addition this entire difficult process is carried out basically by means of manual labor. Not only does this increase the cost of manufacture, but also the needed quality is not always attained.

One of the promising methods making it possible to solve many pressing technical problems simply and reliably is magnetoabrasive machining of outer surfaces. Devices created in our unit for this purpose have earned five author's certificates.

For example one experimental device we manufactured can process not only ferromagnetic materials but also copper, glass and aluminum. Its introduction into a certain air force aviation repair enterprise created the conditions for higher quality machining of smooth cylindrical parts (rods, bolts, plungers, sleeves), as well as parts with complex and discontinuous surfaces—slide valves and pistons. This method can also be used successfully to polish flat surfaces.

The proposed procedure makes it possible to machine complex surfaces of rotation within a short time without having to change the position of the machined part. In this case the procedure does not require high precision when positioning the part to be machined, or adjustment of the cutting tool, which excludes laborious operations from the production process such as hand grinding and scraping.

The design of the device is relatively simple. Part 1 (see figure) is positioned between the pole pieces 2 of electromagnets 3. Depending on the degree of granulation of ferromagnetic powder the gap between the part and the pole pieces is set at a value

$$\delta \geq 3l$$

(where  $l$  is the maximum dimension of one powder grain), and the part is put into motion—rotary around the axis and linear along it. Special devices, in which linear motion is imparted to the electromagnet instead of the part, exist as well. This makes the device more universal and suitable for machining relatively massive parts.

In response to the magnetic field, ferromagnetic powder fed into the working gaps forms into a tight flexible mass that acts as a kind of brush, which is what does the abrasive cutting. Each grain (working element) orients itself in the magnetic field in a certain way: It positions its greatest axis in the direction of magnetic flux lines. Owing to this the sharpest cutting edges face the pole piece and the part. In the course of cutting they lose their properties (they become dull), and the working element reorients in such a way that its new greatest axis coincides with the direction of magnetic flux lines.

It is very important to use lubricating and cooling fluids during machining with the purpose of removing metal: aqueous solutions of kerosene, emulsol E2, or Ukrinol-1 and Akvol-10 emulsions.

Ferroboration, boric and white pig iron, ferrotungsten and other ferrites can be used as the working powder. Special materials have now been created for magnetoabrasive

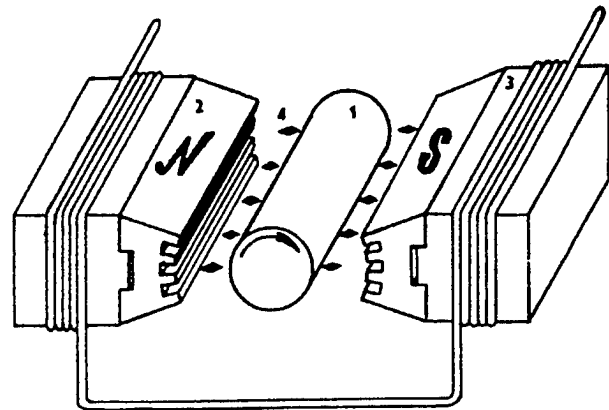


Схема способа магнитно-абразивной обработки: 1 — деталь; 2 — полюсные наконечники; 3 — электромагниты; 4 — абразивный порошок.

#### Magnetoabrasive Machining Method:

Key:

1. Part
2. Pole pieces
3. Electromagnets
4. Abrasive Power

machining. These are cermetes, obtained by pressing and sintering an abrasive and ferromagnetic mixture.

There is one other important advantage of the magnetoabrasive method over the traditional one: The quality characteristics of part surfaces may be controlled within a wide range by setting particular machining conditions.

In this case the principal production factors are the magnetic induction  $B$  in the working gap, graininess, the cutting and magnetic properties of the powder, the size of the gap and the machining time, and the hardness and magnetic permeability of the material. One of the important indicators of this process is its productivity—that is, the intensity with which metal is removed

( $\Delta Q$ )

. In this case the main factors are the hardness and magnetic properties of the material. Tests managed to establish that the greatest intensity of metal removal is observed at  $B=1.1$  T, and that the least intensity is observed at  $B=0.6$  T. This is explained by the fact that as magnetic induction in the gaps increases, cutting forces increase, and favorable conditions are created for contact between the grains and the working surface. The time a surface is machined has a great influence on its quality. Research shows that stable surface quality is achieved in 40-60 seconds ( $R_a=0.02-0.04$  microns, as per All-Union State Standard 2789-73, irrespective of the height of the initial profile of micro-irregularities, which varied from 0.3 to 2 microns).

But of course the main thing is that in addition to obtaining high classes of surface cleanliness, the physico-mechanical characteristics of the part, and chiefly its

microhardness, improve. Residual stresses that positively affect corrosion and fatigue strength are created in the surface layer after magnetoabrasive machining. Another unique feature of the method is that it practically excludes charging of the parts—saturation of their surface by particles of abrasive material. Moreover a charged layer created when a surface is ground with abrasive rings is removed in this case as well. Comparative tests of ShKh-15 steel samples showed that their wear resistance is five to seven times higher following magnetoabrasive machining than that of parts machined by other methods, and that corrosion resistance increases by a factor of 1.5-3. This is achieved owing to formation of a uniform surface layer exhibiting residual compressive stresses that close up microcracks, which reduces the number of corrodible microelements.

When part surfaces are subjected to magnetoabrasive machining, their operating properties improve noticeably: Reliability rises, and the life of aircraft parts and units increases.

This method is presently being introduced into the machining of aircraft engine compressor blades in the aircraft repair regiment in which Lieutenant Colonel A. Razvodkin is the chief engineer. Specialists feel that it will significantly improve the quality of polishing external blade surfaces, and the overall efficiency of the propulsion unit at minimum outlays of materials and labor.

The simple design of magnetic induction coils and the possibility of using existing equipment (lathes, drills, milling machines) will widen the range of applications of magnetoabrasive machining in the future, both at aircraft repair enterprises and in air force units.

**List of Articles Not Translated in AVIATSIAYA I KOSMONAVTIKA No 8, Aug 87**  
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